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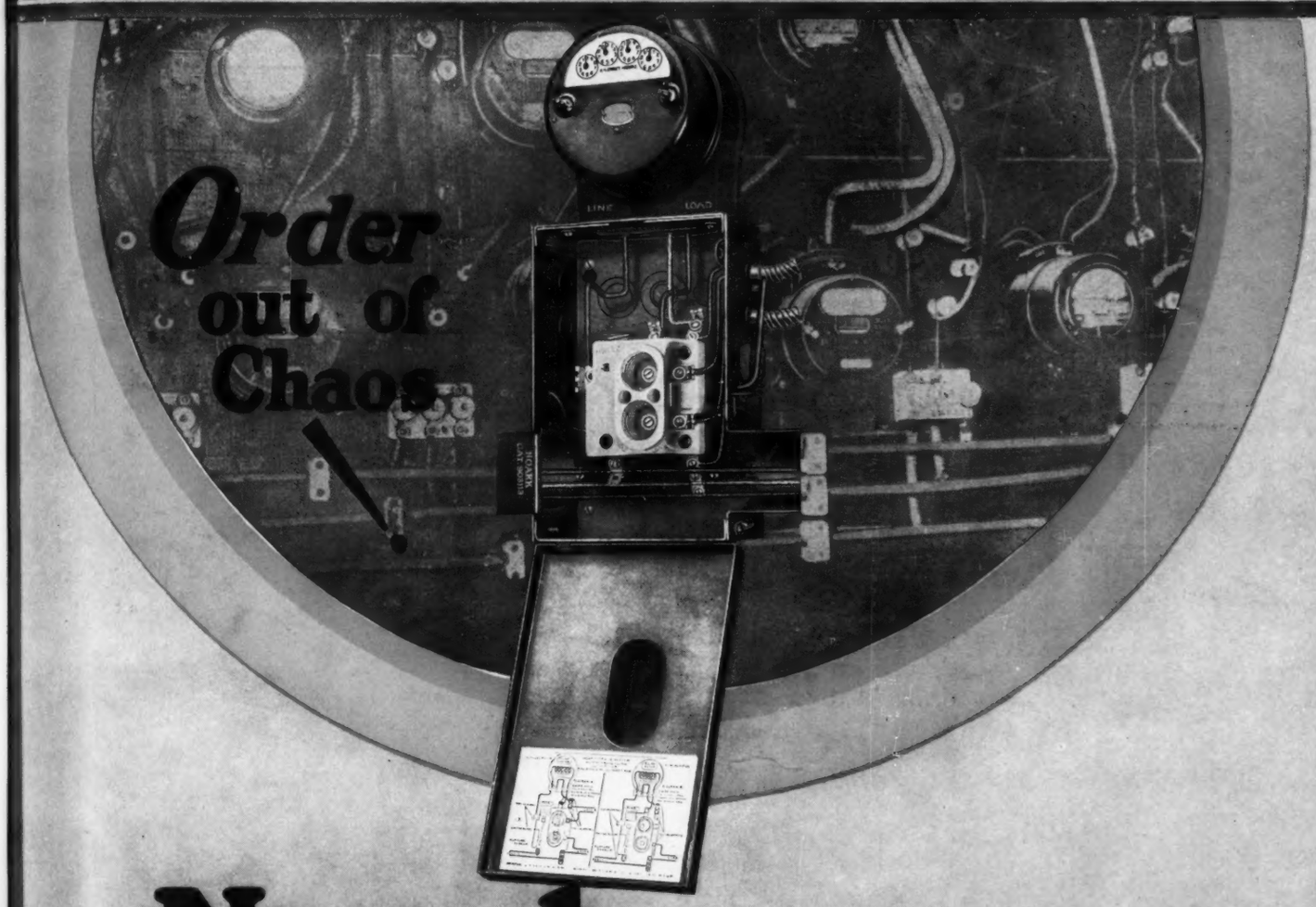

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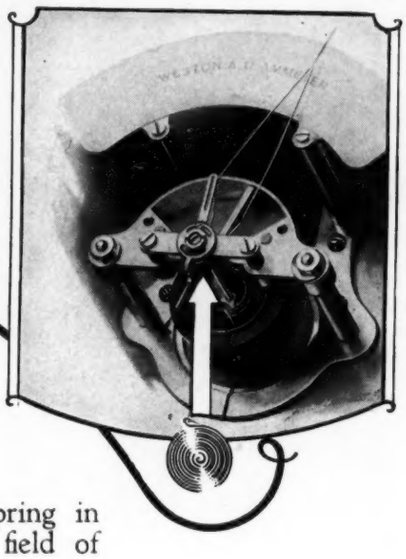

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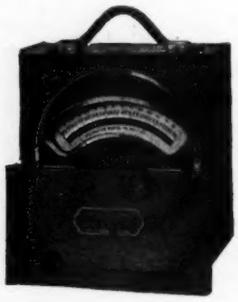

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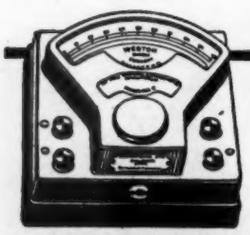

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Electrical World

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Death of Wigginton E. Creed

DEATH removed this week one of the electric light and power industry's most forceful and aggressive executives. Wigginton E. Creed, president of the Pacific Gas & Electric Company, was a product of California and a lover of that state. A lawyer by profession, he specialized in public utility work, obtaining his first experience in waterworks litigation. When he became president of the East Bay Water Company it was in a bad way, physically and financially; but Mr. Creed pulled it out of the slough of despond and made it a factor in the East Bay region of San Francisco. That he should be sought by other and greater interests was but natural, and since 1920, when he succeeded to the presidency of the Pacific Gas & Electric Company, that well-known utility company has become greater and stronger until it is today the dominant public utility company on the Pacific Coast.

Wigginton Creed was a young man possessing all the enthusiasm and gusto of youth, and he was a rich man. He had other large interests in California besides the utility business, so that he was a versatile executive and knew how to build and direct men. A gifted and forceful speaker, personally magnetic and democratic, he was highly esteemed beyond as well as in his native state, and he enjoyed the devotion and loyalty of the organization which grew up around the gentle and lovable pioneer John A. Britton. Of Mr. Creed's many attributes the most outstanding was his aggressiveness. He was an uncompromising opponent of government ownership, insisting that private enterprise was more efficient in performance, more alert in service and more progressive in development. In his untimely death the public utility business in California and in the country as a whole has suffered a great loss. However, his influence in public utility affairs on the Pacific Coast will not soon be lost; for just as an object cast in the water, though it may sink, will cause rippling circles which spread wider and wider, so the impact of a dominant personality will continue to be felt long after its possessor has been removed from the scene of his activities.

New Ways for Old in Industry

THE supremacy of American industry is said to rest upon the use of large amounts of power per worker. But an analysis of many industries shows that this power is used in many forms. Possibly the most efficient and effective form the power takes is in electrochemical and electrometallurgical processes. Here the surface has only been scratched. Quietly and effectively the research laboratories are developing new processes and new materials.

The electric furnace has been responsible for the rapid development of high-grade alloys and tool steel and has gained a recognized place whereby imports have been replaced by exports in large measure. Chromium and nickel-steel alloys are of high strength, ductile and hard, and special chromium alloys now are available which resist oxidation and the action of acids. Electrodeposition has reached a high degree of perfection and has made available to industry new methods and materials. Chromium plating is successful and is replacing other platings where hardness, luster and freedom from tarnish are desirable characteristics. The automotive industry has used this process quite freely. A new achievement is the electrodeposition of rubber. This is done anodically and is said to be adapted to wire insulation and to the production of rubber shapes of any desired character. In japanning, enameling, heat-treating and in the production of brass the electric furnace and oven have become the chief tools to get a uniform and high-quality product. Researches indicate the possibility of producing pure aluminum, pure iron, new and better refractories and a host of other new things for industry through a greater use of the chemical and heat effects of electricity.

Thus mechanical power is only one form of power, and it is in the other forms of power that hope lies for the future of industry. The encouraging part of the industrial situation is the recognition by industry executives that new ways for old, developed through research, open the doors to commercial success.

Knowledge and Science Do Not Compromise

SOME fine distinction between knowledge and scientific information should be made. Science has traveled so far upon the trail of knowledge that we have developed a doctrine of infallibility for it. Those dark ages when the world was unquestionably flat, when all the possible elements consisted of air, fire, earth and water, and when the stars were supported on pillars, seem unbelievably remote. We have journeyed far and fast, and we have, in our mad quest for knowledge and still more knowledge, trampled down, beaten back and willfully denied reasonable doubts. It is the elementary trick of the logician to tell us that we really know nothing whatever, but, after all, there must, in all conscience, be a shadow line.

Science has progressed to a point where the physicist and astronomer deal in incomprehensibles. But a day or so past it was announced that we could now measure heat or differences in temperature commensurable with those of a match flaming hundreds of miles away. We are told that the parallax of a star, which is an ordinary astronomical quantity, is about equal to the apparent distance between two pins placed one inch apart and viewed from a distance of one hundred and eighty miles.

Having conjured up a universe of infinite dimensions and solar systems many times larger than that of ours, science says that the infinitely, inconceivably vast solar system is reproduced in the infinitely, inconceivably small atom. It attempts always to define the unknown in terms of the known. Much of the information and theory developed by science approximates truth and is useful, but there is an uncompensated element in the conclusions. Knowledge cannot be founded on incomplete data. Scientific knowledge lacking completeness becomes pseudo truth. Science has hastened to welcome all assimilable facts—the unassimilable have been shelved until they would fit the current theory. The too general scientific procedure is to maul the facts until they agree with the established yardsticks. We will change our conceptions of the things which we know to be true today by stepping ahead, by moving higher or lower, left or right, but always off the beaten path of current acceptances.

Organizing of the Proposed Refixturing Campaign

THREE points stand out in any study of the broader purposes of the refixturing campaign now in process of organization under the initial leadership of the N.E.L.A. home-lighting committee. The immediate objective, of course, is the installation of better lighting in the eight million homes now using obsolete equipment, according to the prevailing estimate. The idea is to give impulse to a local selling campaign in every community. But the spirit of those campaigns must be carefully controlled if the desired good is to be accomplished.

First—Nothing is to be gained by making this merely a high-pressure sales campaign to market the largest possible number of low-priced, standardized fixtures. Rather, the need is to "sell" to the households of America a more intelligent interest in better home lighting, in terms of eye comfort and artistic design—in short, to sell an idea before taking an order.

Second—The salesmen who engage in this national survey of home lighting must understand that this carries an obligation in every case that the lighting equipment sold should be superior in design and workmanship and more efficient and comfortable in its illumination than the fixtures that are supplanted.

Third—This refixturing and relighting movement—which inevitably will continue for several years—must be so set up that it will have intelligent national direction, with the interests of all branches of the electrical industry well co-ordinated.

The home-lighting committee has in preparation a suggested program for local use with supporting manuals that should make sure the guidance of the work. These plans are being submitted for informal approval to the various other industry associations that are concerned. The active direction of the movement should be put into the hands of a representative general committee that can apportion the various functions to the different associations and to the Society for Electrical Development, this committee to be discontinued when the campaign is over. If the N.E.L.A. should merely start the idea in motion and then call upon the S.E.D. to organize and run it, it would probably wreck the lighting program and the society too, because the society itself is now just being reorganized and refinanced, and under fine auspices.

The S.E.D. will be most helpful. But the responsibility for leadership and broad direction should be assumed by a special industry committee, officially empowered by the organized industry to head this industry job, freely employing all the facilities of the industry to that end. Such a temporary committee will set up no dangerous duplicating machinery to embarrass any existing organization.

Crediting Sales Departments for Additional Business

WIDE differences of opinion exist in utility executive circles at this time upon the amount of credit which properly should be allocated to sales departments for increased business supplied in given territories. Divergent views crop up in singly managed companies as well as in centralized groups, but in the latter the issue sometimes is more acute on account of the tendency of local managements to question the cost of headquarters service. Naturally, each branch of an organization seeks to carry on its work with the lowest admitted cost possible to good service, and in many cases there is a good deal of friendly rivalry in striving to make the lowest feasible total showing in running expenses. On the one hand, there may be a tendency on the part of sales forces to claim maximum results from their efforts and co-operation, and on the other we often see too little realization on the part of local executives of the lasting value of headquarters staff work.

Obviously, growth of business expressed in kilowatt-hour sales and revenue therefrom is due to many factors. Some growth occurs without regard to special sales effort. Improved window lighting in one section of a business district leads to better illumination in neighboring streets; a few high-grade signs stimulate the installation of others, and modernized store interior lighting stirs many merchants to action along similar lines. The proper bases of departmental credit deserve study in order that fair allowances shall be made for the work done when the accounting staff starts to allocate the costs. At present extreme differences in view hamper these allocations in companies which might be cited, but the real need of the situation is for the various executives and engineers concerned to reach a non-frictional working agreement. Where efficient staff work proceeds from headquarters with good field co-operation, the growth of lighting business in particular generally reaches totals that leave a substantial spread between costs and results. In a representative case the headquarters staff contributed to new-business development on the basis of producing by all causes fourteen dollars' worth of additional revenue for every dollar of staff expense, and it would seem as though there could be small cause for looking upon centralized service as costly under such an arrangement. Each company and headquarters management must study such problems as these on their own merits, but in general it is safe to say that a liberal attitude toward sales promotional costs pays best in the long run, even if some of the new business attained might be classed as self-starting. The light and power industry as a whole needs to adopt a broad policy in the important matter of load building, and while good sense demands a reasonable check upon selling costs, it is a mistake to put too much emphasis upon credit outlays which represent but a few per cent of revenue growth.

Combining Substations in Small Cities

BETTERMENT work in small cities and large towns served by central stations relying upon transmitted power offers not a few opportunities for analytical study along the line of substation location. Many such communities are passing through transition periods in load distribution; others are developing in directions unforeseen by the promoters of the small local generating plants which are today relegated to history or held for reserve use, and others still are marking time, with little to indicate either the volume or the trend of business in the future. There has too often been apparent among local distributing companies a habit of following the lines of least mental resistance in regard to the introduction of purchased energy into the community, and substations have been placed in situations which engineering investigation would never countenance.

Here the step-down transformers tied into the incoming line have been located beside the gas house of a combination company because of owned land and the presence of continuous attendance; there the reduction in voltage has been made in a bull pasture a mile outside the town center on account of the cheapness of real estate and possibly with a weather eye to the police powers of the king of the herd. In another case, where incoming power is received over lines entering the town on the north and the south, transformer "subs" were established about half a mile apart with the business center between.

In view of the importance today accorded distribution system design and maintenance, and the relation of distribution costs to the selling prices of electrical service and possible reductions in maximum rates with all their public relations bearing, it would seem to be time for forward-looking companies operating in small communities to investigate the suitability of their transmission substation locations with regard to load trends and the possibility of combining step-down, switching, protective and feeder equipment for better service. This problem is but a single facet of the larger issue of distribution system betterment, but even casual observation of conditions in many small places indicates a real opportunity for the practice of betterment engineering.

Why Not Raise Lamp Voltages?

THE alternating-current secondary network for combined light and power service is a logical development for service in congested areas. But any such network must be measured in terms of service, and a meritorious network should give better service than the distribution system it replaces. It also should make for economy not only in the part of the system to which it is applied but in the system as a whole. To meet these specifications is difficult with the unfortunate voltage relations existing in present systems and in the normal four-wire Y network. The 115/230-volt relationship must be considered in terms of 115/199 volts or 120/208 volts. And, aside from questions of complexity and troubles with new devices for network operation, the voltage problem is the fundamental consideration. A basic premise is that, for the system as a whole, economy is had when distribution voltages are increased.

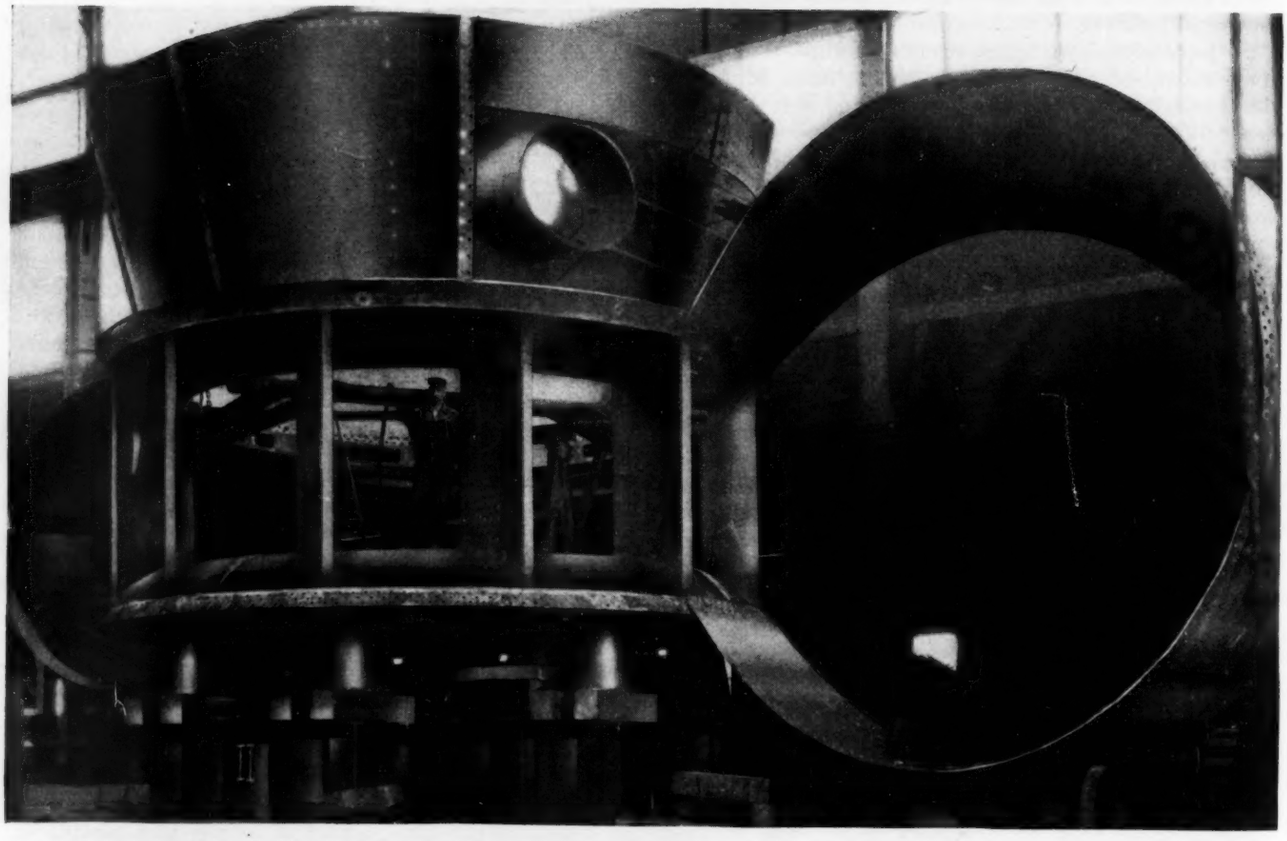
An interesting study of the network situation can be had by making comparisons on the basis of the same lamp voltage and on the basis of gradually increasing the standard lamp voltage. In the course of a few years it might be a good thing to increase the standard lamp voltage in successive steps to 120, 125, 130, and finally end with the 135/230-volt system used in Europe. Lamps, small single-phase motors and heating elements might well be subjected to these changes at economic intervals. The cost, because of inherent short life, low unit cost, rapid changes in quality, etc., would be negligible. Before final decisions are made as to network practice on an industry-wide scale, the whole subject should be studied carefully so that gains, not losses, will result in terms of both dollars and service for utility systems as a whole. This study is going on, and the final decision may be expected in the near future. Both theoretical and installation data are now available to those who are occupied with this particular industry problem.

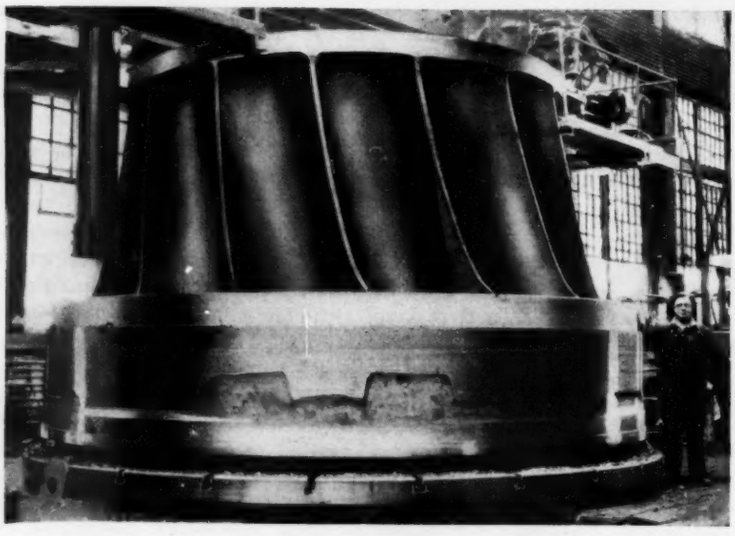
How Artificial Light May Aid Horticulture

FOR several decades experiments have been conducted with artificial light to determine its effect upon plant growth. Some of these have been of purely scientific outlook and interest, the object being to obtain knowledge relating to radiation and plant behavior. Other experiments have been conducted from a more commercial viewpoint by investigators, usually not specialists in horticulture. As a rule the use of artificial light has not been justifiable commercially, at least at the present cost of electrical energy. However, there has been a lack of completeness in these investigations. Usually, one group of plants has been subjected to artificial light continuously, instead of ascertaining what effect a few hours of intense artificial illumination might have in addition to the usual exposure to daylight. This has been found effective in increasing egg production by keeping the hens active longer than they would be during the season when daylight is of short duration.

That artificial light will some day be used effectively and profitably in forcing plants one can scarcely doubt. It is a matter of economics which involves the kind and value of plant, the season, the locality and the cost of light. When this day shall arrive is a matter of conjecture, but recent experiments in Sweden are interesting. In that country the intensity of daylight illumination during the winter months is relatively low. According to the report, one-half of a greenhouse was covered completely with heat-insulating material. In this an intensity of 15 to 30 foot-candles was obtained with gas-filled tungsten lamps. The other section was lighted only with daylight. The entire greenhouse was heated electrically. The foliage of the plants developed more rapidly under the artificial light than under the daylight. Hyacinths were forced to bloom under the former in five days, although nine days was required in the daylighted section. An important conclusion was that the cost of heating in the heat-insulated section was greatly reduced. The saving of 70 per cent in the cost of heating could be spent on artificial light. More such data are needed. Under appropriate economic conditions perhaps we are nearly ready for the serious application of artificial light in the direction indicated.

Conowingo Turbines, Rated at 60,000 Hp., Going Through the Shop





FOUR turbines for the Conowingo development of the Susquehanna Power Company (Stone & Webster, Inc., engineers) are being built by the Allis-Chalmers Company. In dimensions, these turbines are the largest yet built, according to reports, and their unit ratings of 60,000 hp. are exceeded only slightly by some of the machines at Niagara. The spiral casing, partially completed, and speed ring, which are shown partly assembled, have an inlet diameter of 27 ft. and an over-all width of 65 ft. The 27-ft. butterfly valve will perform the double duty of turbine shut-off and penstock headgate. It is designed for an operating time of three minutes or less under a working head of 89 ft. The runners, which are cast in three sections, weigh 100 tons each. A Holyoke test of one of the models of these turbines showed an efficiency of 93.34 per cent.

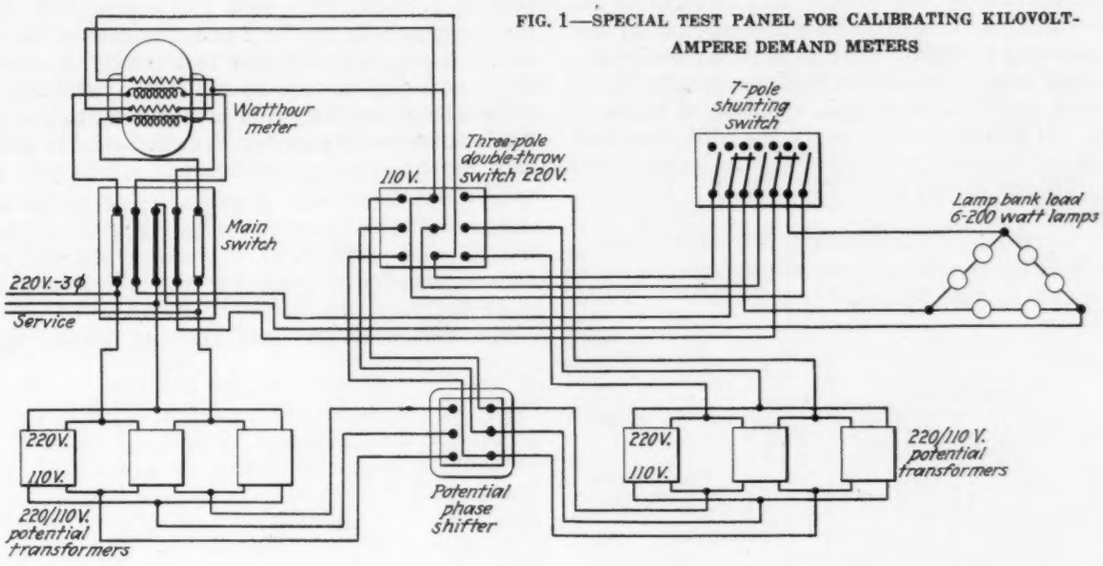


FIG. 1—SPECIAL TEST PANEL FOR CALIBRATING KILOVOLT-AMPERE DEMAND METERS

Power Factor Investigations

Use of Kilovolt-Ampere Demand Meters for Testing Power Factor Conditions in Industrial Plants—Connections, Charts, Reports—Test Precautions and Calibrating Facilities

By L. D. Price

Division Meter Chief Public Service Electric & Gas Company, Paterson, N. J.

A LARGE number of electric utility operating companies have included power factor clauses in their power contracts, fixing the minimum average power factor at which a customer may operate. If these clauses do not provide a penalty for poor power factor necessitating special metering equipment to record kilovolt-amperes or reactive kilovolt-amperes, periodic tests must be conducted to ascertain whether the customer's plant is operating at a power factor within the terms of his contract. It is the aim of every utility to sell its energy as cheaply as possible and to render efficient and reliable service. The power factor investigations of a customer's plant help to achieve these ends.

If a plant is found to be operating at a poor power factor, the customer is advised to take steps toward increasing it to at least the required value. In general, the cause of low power factor in an industrial plant is improper application of induction motors, such as overmotored loads and inefficient grouping of loads for motor drives. By conducting a thorough investigation throughout the plant the duty cycles of all loads can be studied. The load can then be redistributed in order that the induction motors can carry as nearly full load as possible at all times, thereby increasing their average power factor. This results in greatly increased efficiency in plant operation, decreased copper losses in the plant distribution system due to the decrease in magnetizing current necessary for induction motor operation at an increased power factor, reduction of total connected motor load of plant and, most important, increased production due to higher voltage and better regulation increasing the speed of the motors.

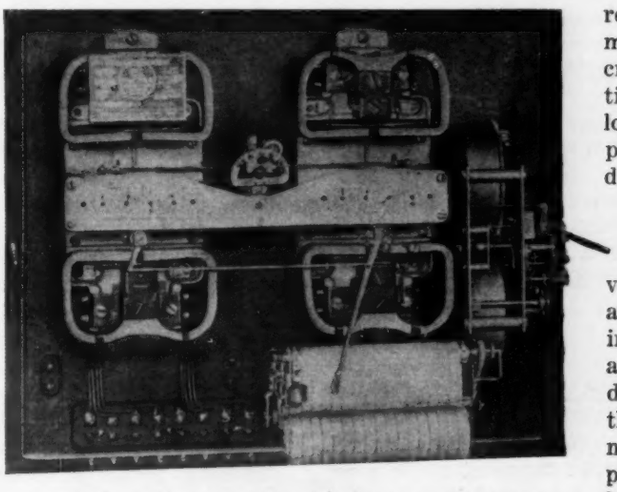


FIG. 2—KILOVOLT-AMPERE DEMAND METER USED IN INVESTIGATIONS

The results of these investigations should be kept available for ready reference in case the customer should apply to the company for additional load. In many cases the application of synchronous machinery to the proposed additional load benefits both customer and company. If a synchronous motor,

Fynn-Weischel or similar motor, is applicable to the particular load, such an installation should be advised by the operating company. The plant power factor may be increased to such an extent that no increase in the size of main switching equipment and general wiring of the plant will be necessary to carry the additional load. The resulting increased power factor also increases the general efficiency of the plant, as outlined in preceding paragraph.

A very satisfactory instrument for investigations of this nature is the type RI kilovolt-ampere demand meter manufactured by the Westinghouse Electric & Manufacturing Company. The meter records graphically the simultaneous integrated maximum demands of kilovolt-amperes and kilowatts over a time interval of 15 or 30 minutes, and also registers kilovolt-ampere-hours and kilowatt-hours on the two dials. An indicator also shows the instantaneous power factor of the load which is being investigated.

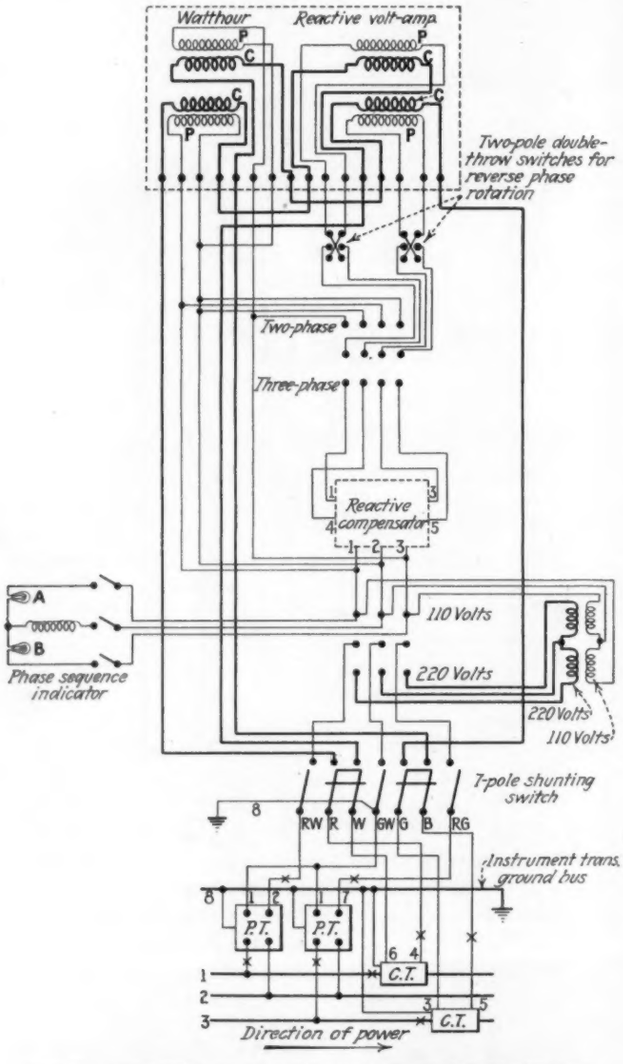
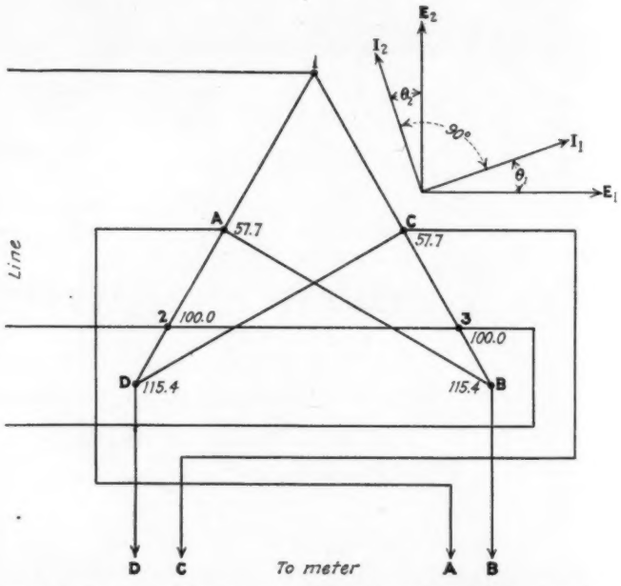


FIG. 3—ASSEMBLY OF EQUIPMENT AND CONNECTIONS FOR INVESTIGATING POWER FACTOR CONDITIONS IN PLANTS

The meter consists of two polyphase meters, one connected to register the kilowatt active component of the power and the other connected to register the reactive kilovolt-ampere or wattless component of the power. The two meter elements are connected by a register having a ball mechanism in order to produce kilovolt-ampere registration. This ball mechanism is shown diagrammatically in Fig. 8 and operates on the principle that a, being perpendicular to the axis of rotation xy, is proportional to the speed of the watt-hour meter element, and similarly b is proportional to the speed of the reactive meter element. The ball rotates around the axis xy at a speed proportional to c, which is equal to $\sqrt{a^2 + b^2}$ and hence is proportional to the kilovolt-amperage. The kilowatt register is geared directly to the kilowatt element of the meter and the kilovolt-ampere register is geared to the wheel W through a movable frame.

The kilovolt-ampere and kilowatt demand record is made on a moving chart by a pen which is actuated through the kilovolt-ampere register mechanism, and therefore its rate of movement across the chart is proportional to the kilovolt-amperage of the load. The kilowatt demand is obtained by means of a dog driven by the kilowatt register gear train, which stops the return of the pen for an instant after it has been released from the kilovolt-ampere register by the clock mechanism. The pen is then released again and reset to zero. As the clock is driving the paper chart forward during the resetting period a distinct mark is left showing the integrated kilowatt demand as well as the integrated kilovolt-ampere demand.



FIGS. 4 AND 5—REACTIVE-COMPONENT COMPENSATOR CONNECTIONS AND TWO-PHASE VOLTAGE AND CURRENT RELATIONS

Voltage and current relations for two-phase circuits are shown in the upper right diagram. The polarity of E_1 is reversed to give an instantaneous 90 deg. lag displacement.

Reactive component compensator connections to secure voltages corresponding to phase voltage magnitudes on three-phase circuits and lagging 90 deg. are shown in the larger diagrams.

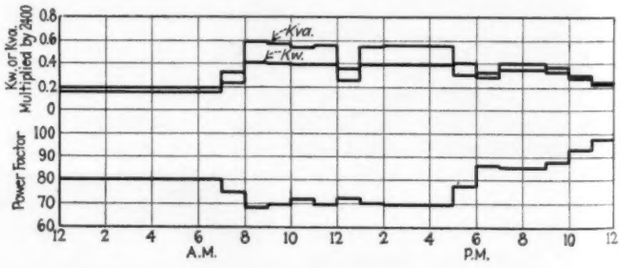


FIG. 6—A 24-HOUR CHART PLOTTED FROM DEMAND CHARTS OF RI METER

Some advantage of this type of instrument for central-station testing are: (1) The familiarity of the meter men with the operation and adjustment of the ordinary induction type watt-hour meters that form the fundamental operating units of the instrument; (2) their knowledge of the operation of the hand-wound tripping mechanism through their contact with recording watt-hour demand meters; (3) simultaneous chart readings of kilovolt-amperes and kilowatts on the same chart, eliminating the error introduced by incorrect time ordinates of two separately driven charts; (4) simplified calculations minimizing the human error of computations; (5) ruggedness and ease with which calibration can be made.

In order to facilitate testing and to minimize the probability of error in connection, the writer has developed a compact assembly of apparatus for conducting plant investigations. Secondary instrument transformer connections are made to a seven-pole testing switch consisting of three single-pole switches in the potential circuit and two double-pole short-circuiting switches in the current circuit. The current leads are connected directly to the meter, with the two upper meter elements in series and the two lower meter elements in series. The potential circuit is connected to a three-pole double-throw switch, one side of which feeds the high-voltage side of 220/110-volt potential transformers, the other side being directly connected so that the switch may be thrown in one direction for primary tests where potential transformers are used to step the potential down to 110 volts or thrown in the opposite direction for secondary tests where 220 volts are used directly.

Basic Relations Outlined

In alternating-current circuits

$P = E \times I \times PF$

P = power in watts

E = electromotive force in volts

I = current in amperes

PF = power factor in per cent, the cosine of the angle by which the current leads or lags the voltage, cos θ.

KW = the power available for useful work or active component of the power.

$RKVA$ = the wattless or reactive component of power.

KVA = the apparent power of the circuit, or the vector sum of KW and $RKVA$.

$\text{Cos } \theta = PF = KW \div KVA = P \div (E \times I)$

$KVA = \sqrt{KW^2 + RKVA^2}$

The $RKVA$ component may be either 90 deg. leading or lagging, producing a leading or lagging power factor. Leading power factor is produced by apparatus possessing condensive reactance, such as static condensers and synchronous motors, and lagging power factor by inductive apparatus such as induction motors.

For two-phase circuits

$P = E_1 I_1 \cos \theta_1$ (phase 1) $+ E_2 I_2 \cos \theta_2$ (phase 2)

Where E = phase voltage

I = phase current.

As previously stated, the reactive component ($RKVA$) of the apparent power (KVA) is 90 deg. displaced from the actual power (KW) component. It is therefore necessary in measuring this $RKVA$ component to produce a voltage with 90-deg. lag displacement from each phase voltage. This can be accomplished in two-phase by staggering the potentials in the reactive KVA element—that is through one element of the meter pass the current of one phase and the voltage of the other and through the other element vice versa, or through one element pass I_1 and E_2 and through the other element I_2 and E_1. The polarity of one voltage is reversed to secure the 90-deg. instantaneous lag displacement.

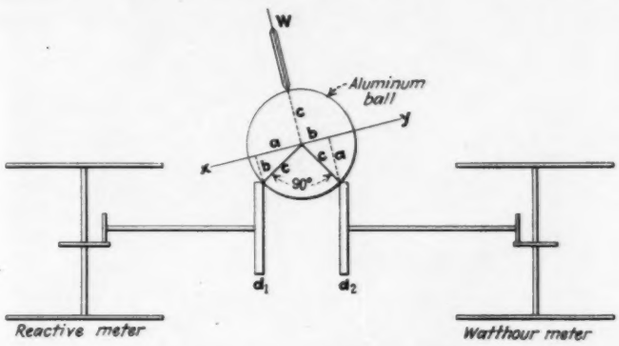


FIG. 8—PRINCIPLE OF BALL AND MECHANISM USED IN THE KILOVOLT-AMPERE DEMAND METER

For three-phase circuits some other means must be employed to produce the 90-deg. lag displacement of voltage, as the voltages of a three-phase circuit are displaced from each other by 120 deg.

An auto-transformer or reactive component compensator (see Fig. 3) is used with proper taps so that voltages of magnitudes equal to the phase voltages and lagging by 90 deg. are produced, as may be seen in Fig. 4.

Voltage B-A = voltage 1-2 and lags by 90 deg.

Voltage C-D = voltage 1-3 and lags by 90 deg.

There are two conditions that cause the reactive KVA element to rotate backward—leading power factor and reverse phase rotation. To produce a leading power factor, synchronous apparatus or static condensers must comprise a portion of the load, so that if no such apparatus is connected and the meter rotates backward,

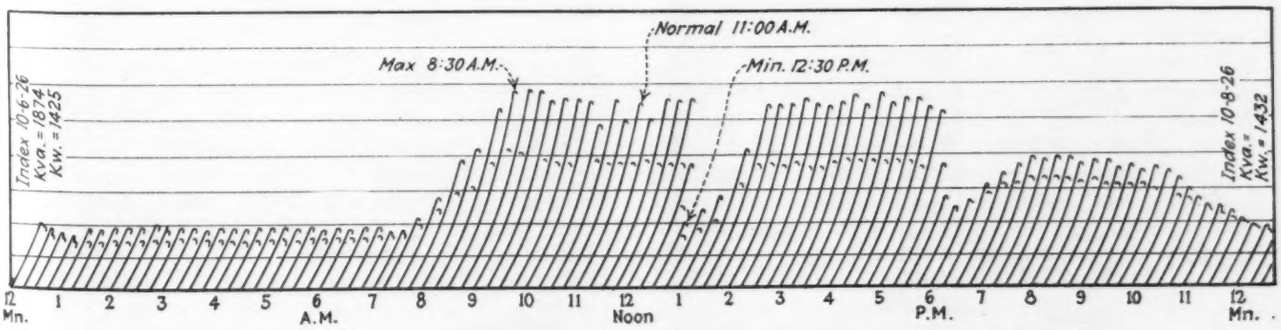


FIG. 7—DEMAND CHART FROM TYPE RI METER

the sequence of phases must be reversed—that is, the line voltages reach their maximum values in the order *C-B-A* instead of *A-B-C*. There are times. however. when it is impossible to tell from observation which of these conditions causes backward rotation. A phase sequence indicator may be readily constructed to show the sequence of phases by means of two lamps and an impedance coil (potential element from meter) connected as shown in Fig. 3.

When connected as shown, lamp *A* will be bright and lamp *B* dim. By having a known lagging power factor

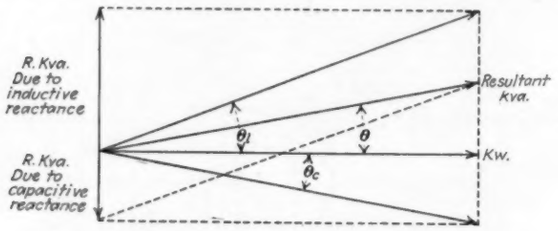


FIG. 9—A COMBINATION OF LEADING AND LAGGING REACTIVE KILOVOLT-AMPERES

Cos θ = resultant power factor.
Cos θ_L = lagging power factor.
Cos θ_C = leading power factor.

the potential connections to the *RKVA* meter can be so made that forward rotation is produced. If on certain installations lamp *B* shows bright, the potential connections to the *RKVA* meter must be reversed. If the meter is connected for standard phase sequence and lamp *A* shows bright while the *RKVA* meter rotates backward, leading power factor is indicated. The reversing of the potential leads can best be accomplished by installing two-pole double-throw switches, as shown in Fig. 3.

The entire apparatus is mounted in a wooden cabinet approximately 5x3x3 ft., with a partition dividing the cabinet vertically in the center. The meter and shunting switch are mounted on the front face of the partition, and the various switches, transformers and wiring are on the reverse side. Double swinging doors with locks are provided to make the instruments accessible only to authorized employees.

In practice it is necessary to report the results of power factor investigations in such a way that only the important results are brought to the attention of the executives of both the customer's plant and the company. Representative charts are taken from the type RI meter covering a period of 24 hours, and from these charts reports may be made up. These reports give the kilovolt-ampere and kilowatt demands, the power factor at maximum, minimum and normal loads during the day and the average integrated power factor taken from the dial readings of the instrument. A more comprehensive picture of the operation of the plant may be plotted (Fig. 6), where average hourly demands of kilovolt-amperes and kilowatts and the average hourly power factor are represented. These values may be plotted directly from the chart readings and the chart constant applied as shown in the left-hand margin. The only computation necessary is the division of the kilowatts by the kilovolt-amperes to get the power factor.

In order to provide facilities for calibrating these instruments in the laboratory, the writer has constructed a special test panel (Fig. 1). A three-phase 220-volt service is connected through a meter service cabinet and meter to a three-phase delta-connected lamp bank. The two outer phase wires are connected through the current coils of the meter, through the current short-circuiting switches of a seven-pole testing switch to the load. The meter potential coils and potential blades of the testing switch are supplied from the secondary side of a three-phase potential phase shifter (States Company, Hartford, Conn.). This phase shifter is rated at 110 volts and is therefore connected to the secondary of a bank of 220/110-volt potential transformers. Another bank of these potential transformers steps the voltage back to 220 volts. Leads are taken from the primary and secondary of the second bank of transformers to a three-pole double-throw switch. The blades of this switch are connected to meter potential coils and potential blades of the testing switch, making 220 or 110 volt, three phase, any power factor, available for testing purposes. By connecting the RI meters to the seven-pole testing switch as shown in Fig. 3 and inserting indicating ammeters, voltmeters and a polyphase wattmeter in the same circuit, the performance of the instrument can be very thoroughly and accurately checked. The average readings of ammeters and voltmeters taken over the period of demand interval multiplied by 1.732 (that is, $\sqrt{3}$) should equal the recorded demand in kilovolt-amperes. The average reading of the wattmeter should equal the recorded kilowatt demand.

No.....

RECORD OF PERIODICAL POWER FACTOR TESTS

NAME John Doe Corporation

DISTRICT Paterson ADDRESS East Railway Avenue, Paterson

CIRCUIT NO. 4006 METER NO. 85632 DIAL K. 2400

P. T. RATIO 20-1 C. T. RATIO 120-1

Date: 10-8-26	HOUR	K.V.-A. CHART K	READING	ACTUAL K.V.-A.	K.W. CHART K	READING	ACTUAL K.W.	K.V.-A.	P.F.
Min. 10-6-26	12:30 PM	2400	0.2	480	2400	0.16	384		80.0
Normal 10-6-26	11:00 AM	2400	0.55	1320	2400	0.38	912		69.1
Max. 10-6-26	8:30 AM	2400	0.58	1392	2400	0.42	1008		72.5
Integrated from: 10-6-26	5 PM	2400	1874.0	22000	2400	1425	16800		Average:
to: 10-8-26	8 AM		1883.2			1432			76.4

SIGNED APPROVED

FIG. 10—TYPICAL REPORT FORM MADE FROM DEMAND CHARTS OF RI METER

Operating Department Organization

Alabama Power Company Divided Into Four Divisions, Each of Which Assumes Responsibilities for All Activities and Maintains Company's Policies and Properties in Its Territory

By G. H. Middlemiss

Superintendent of Distribution Alabama Power Company, Birmingham, Ala.

TRANSITION periods in public utility development call for far-sighted engineering, operating, commercial and financial programs and open-minded policies if costly mistakes are to be avoided and systems built up and co-ordinated on sound premises. The presence of expanding utility interests over large areas makes it difficult at times to co-ordinate engineering and operating problems on the basis of the greatest economic good to the company and to the territory served. It is necessary for all interested parties to exhaust all possible means of getting together and agreeing upon comprehensive programs of development and growth in order that capital may not be wasted and needless losses incurred.

In outlining the operating department of the Alabama Power Company, its organization and manner of functioning, the author writes with considerable enthusiasm over its successful working. Of course the organization is not perfect, nor can it be presented as a model for other companies to follow. It is not a panacea for all the difficulties arising in the course of contact among various personalities. The plan of organization has been an outgrowth, fitted to the particular conditions that have existed and to the temperament and abilities of the personnel available, and as such it has functioned unusually well and is still so functioning.

Development of Organization

When the company was small, there was a group of men headed by an operating superintendent in the central office and responsible for directing all field activities. As load developed and the area of service widened, it became increasingly difficult to supervise effectually from a central point. Two geographical divisions were formed and each was placed in charge of a division superintendent, who instructed the line gangs and the maintenance men relative to upkeep of the physical property. Later it became necessary to have four divisions, each of which was placed in the charge of a division manager.

MAIN OFFICE BUILDING OF THE ALABAMA POWER COMPANY LOCATED IN BIRMINGHAM, ALA.

These are essentially the conditions that exist today. The division manager has absolute control of his particular territory. He assumes responsibility for all activities, maintains the company's policies as to relationship with customers, commercial matters, upkeep of all properties except generating plants and represents the company in all phases of community life. The division superintendent reporting directly to him attends to the maintenance of the high-tension system, including lines and substations, and the various local and district managers in charge of towns and communities look to the division manager for counsel in the solution of their specific problems and for guidance in the prosecution of their work.

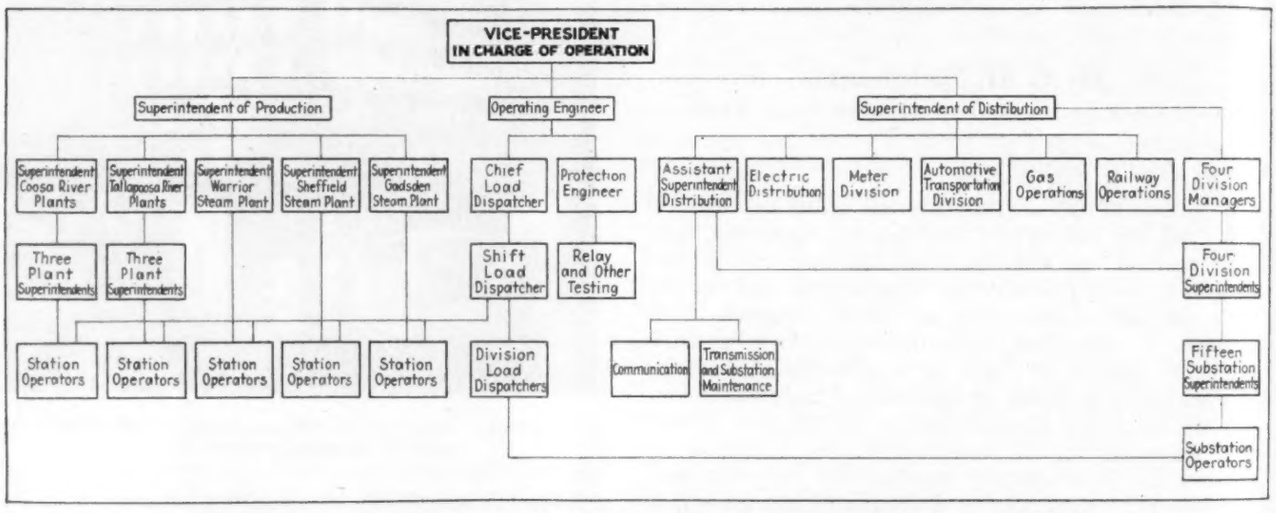
While these changes were taking place in the field, similar development occurred in the central office. The position of operating superintendent ultimately became that of vice-president in charge of operation, with three departments under his immediate supervision, acting in a directional and advisory capacity. Direct responsibility for the maintenance of the properties was thus taken away from the central office and transferred to the field. Decentralization became an accomplished fact, in so far as practicable under existing conditions.

Maintenance of existing properties and operation, in certain aspects, are generally supervised by two departments—production and distribution—as shown in the accompanying organization chart. The production department, with its organization, is responsible for delivering the kilowatt of energy to the transmission lines

at the generating plants. The distribution department begins at this point and distributes the current to the ultimate customer, whether it be a large industrial user or a modest residence in a small town. The superintendent of production contacts with the various superintendents in charge of certain plants or groups of plants and advises or instructs them relative to the problems pertaining thereto.

DISTRIBUTION DEPARTMENT

In the office of distribution are several department heads responsible for various activities pertaining to all properties except those of the generating plants. The assistant superintendent contacts with the four division superintendents who look after the upkeep of lines and substations. Aside from the high-tension system, other divisions of the work include low-voltage distribution lines within municipal territory and rural districts, gas production and distribution, railway operations and automotive transportation. All of these department heads act through members of the divisional organization for the promotion of better results in the field where the dollars and cents are spent and where high standards of service are to be maintained.



ORGANIZATION CHART OF THE OPERATING DEPARTMENT OF THE ALABAMA POWER COMPANY

Early in the development of the operating organization the management recognized the importance of centralizing under one group of engineers the problems pertaining to generation, load dispatching, relay application and relay adjustment. Thus the position of operating engineer was established, and it will be noted from the chart that the chief load dispatcher and the division load dispatchers report to his office. Aside from the specific duty of this department to operate the entire system impartially and in a manner to secure the greatest over-all efficiency, it is responsible for the solution of the technical problems pertaining to the operating characteristics of the generators, lines, substations, short circuits, voltage deficiencies and for testing and adjusting relays under a co-ordinated plan for the purpose of obtaining the most successful operation in case of trouble.

The chief load dispatcher has a line of contact with all operators at generating stations under the supervision of the production department and with all operators at substations within the divisions. He directs switching operations, prescribes load division on various plants, applies correction for improper voltage conditions and issues instructions relative to the physical connection or disconnection of apparatus from service.

It will thus be seen that whereas lines of authority are developed under three distinct departments, nevertheless functional activities are so tied together that the group as a whole works in perfect harmony.

Through the far-sighted vision of the management every employee early in his training has learned the necessity of giving careful consideration to the other person's viewpoint where there is a mutual interest in the development of a project. Within the company round-table discussions of all phases of any situation, whether pertaining to operating matters or engineering detail, have been freely and frankly entered into. Where shortcomings in methods or organization became the issue, everyone interested agreed upon the remedy. Where the solution of a problem admitted of exact analysis, this analysis was followed, and where questions of judgment were involved, the final decision was based upon the opinions of those most interested. As a consequence, the three departments—production, distribution and operating engineering—have worked through a number of years in very close harmony and mutual understanding.

It may be of interest, in conclusion, to outline briefly the process for co-ordinating the activities of the operating and engineering departments. Under the idea that the operating department must care for the property from its creation to its old age, engineering plans are drawn and apparatus chosen which meets the viewpoint of the operating personnel, in so far as is reasonable. Thus the three department heads, functioning as described above, devote considerable attention to the general features of any new project under development. Their associates also help to inspect work in progress and represent the operating department in the final inspection and acceptance of the job. Furthermore, constant endeavor is made to spread to the men in the field the thought of responsibility and interest as to features of any new undertaking, and after plans and specifications have been completed in the engineering department and accepted by the central office, they are distributed to the proper department heads in the divisional organization in sufficient time for comment as to details which might be changed to advantage.

Operating Plans and Expected Costs of Conowingo

Plant Will Ultimately Develop 594,000 Hp. in Eleven 40,000-Kva. Generators—Expected Distribution of Investment and Method of Operating Under Light and Peak Loads During Low and High-Flow Periods

THE Conowingo hydro-electric plant, which is being built for the Philadelphia Electric Company, will ultimately make use of the entire normal flow of the Susquehanna River and will rank among the largest hydro-electric plants of the country. When completed, it will develop 594,000 hp. in eleven main waterwheels, seven of which are being installed initially. Each unit will be connected to a 36,000-kw. generator, making the ultimate capacity 396,000 kw. and initial capacity 252,000 kw. The initial power so developed will be transmitted to Philadelphia over two 220,000-volt circuits, each capable of carrying the entire initial output of the plant. In Philadelphia these lines will be paralleled with the existing steam-generating stations of the Philadelphia Electric Company, having a total capacity of about 550,000 kw. It is expected that the initial installation will provide about 1,150,000,000 kw.-hr. annually from waterpower, which will make possible the saving of nearly 750,000 tons of coal.

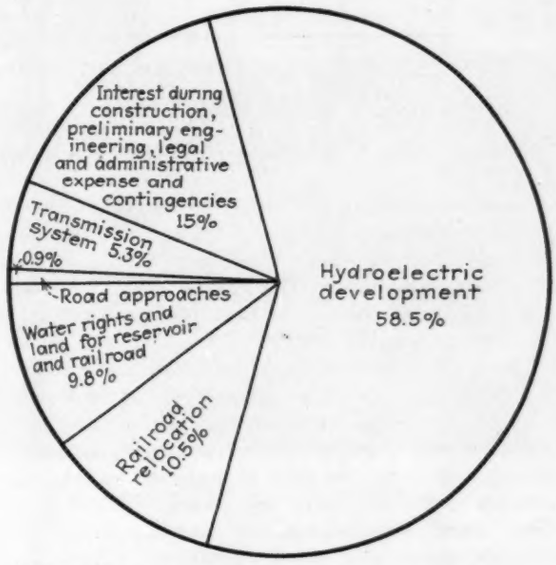
Susquehanna Has Variable Flow

With the exception of the St. Lawrence, the Susquehanna River basin is the largest and most important on the Atlantic coast, embracing a total watershed of 27,400 square miles. Like all other Pennsylvania streams, the Susquehanna River has an extremely variable runoff from day to day, from week to week and from season to season. A maximum flow occurred in June, 1889, with 730,000 cu.ft. per second. The minimum recorded flow was in 1909 and measured 2,200 cu.ft. per second. High water frequently occurs in January from melted snow. Floods accompanied by ice gorges occur usually in March and result in a high water level, although with a lesser volume of flow than at times of clear water floods caused by heavy rainfall occurring over the whole or a portion of the watershed as late as June. Periods of low water are frequently noted in late summer or fall.

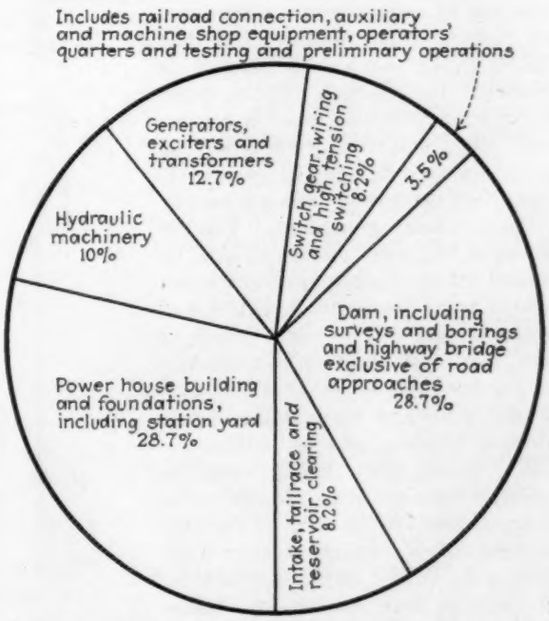
By agreement with the Pennsylvania Water Power Company a pond elevation will be established by the Conowingo dam, which will back the water up over a portion of the Holtwood plant tailrace. This has been done because the additional head can be developed more economically at Conowingo; the gain accruing from the increased head will be shared between the two companies.

14,000,000,000 Cu.Ft. Storage

The lake formed by the dam will be approximately a mile wide, will extend up the river about fourteen miles, will cover nearly 9,000 acres and will contain about 14,000,000,000 cu.ft. of water. To flood this


Interest during construction, preliminary engineering, legal and administrative expense and contingencies 15%
Transmission system 5.3%
0.9%
Road approaches
Water rights and land for reservoir and railroad 9.8%
Railroad relocation 10.5%
Hydroelectric development 58.5%

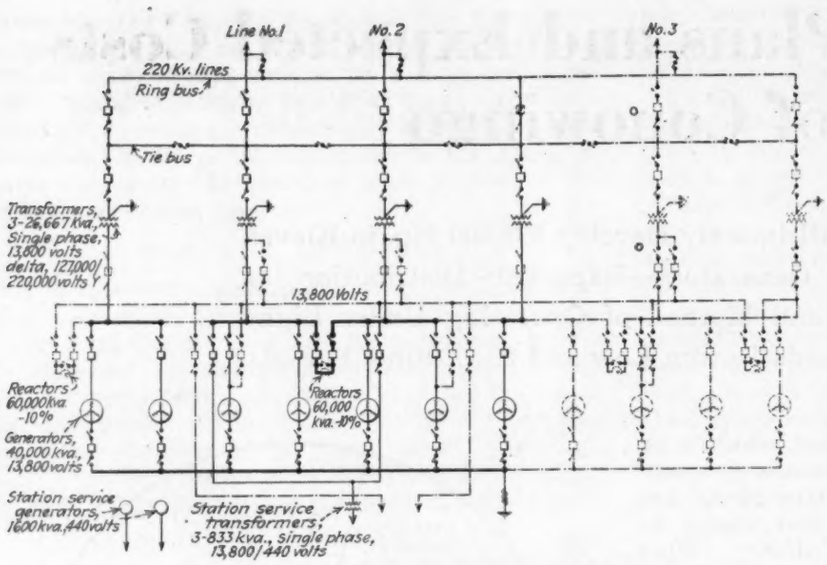
$52,220,000 for Plant and Transmission Line


Includes railroad connection, auxiliary and machine shop equipment, operators' quarters and testing and preliminary operations
Generators, exciters and transformers 12.7%
Switch gear, wiring and high tension switching 8.2%
3.5%
Hydraulic machinery 10%
Dam, including surveys and borings and highway bridge exclusive of road approaches 28.7%
Power house building and foundations, including station yard 28.7%
Intake, tailrace and reservoir clearing 8.2%

$30,595,400 for Hydroelectric Development alone

HOW $52,000,000 WILL BE SPENT ON INITIAL DEVELOPMENT OF 252,000 KW.

Considerable of the expenditure made for the initial development will not have to be duplicated in extending the plant so the unit cost of the ultimate development will be lower.


Line No.1
No.2
No.3
220 Kv. lines
Ring bus
Tie bus
Transformers, 3-26,667 Kva., Single phase, 13,800 volts delta, 127,000/220,000 volts Y
13,800 Volts
Reactors 60,000 kva. -10%
Reactors 60,000 kva. -10%
Generators, 40,000 kva., 13,800 volts
Station service generators, 1600 kva., 440 volts
Station service transformers; 3-833 kva., Single phase, 13,800/440 volts

INITIAL AND ULTIMATE BUSES FOR 13,800-VOLT AND 220,000-VOLT CIRCUITS

area required moving the adjacent branch of the Pennsylvania Railroad to a higher level and building a highway bridge over the crest of the dam.

The dam, which is of the gravity type, will be 4,630 ft. long and will have a spillway section 2,385 ft. long. The normal head of water maintained will be 89 ft., but provision is made to take care of considerable variation, depending upon the amount of water flowing in the river, by means of three regulating gates for fine regulation and crest gates for coarse regulation. The spillway section of the dam is designed to take care of floods up to 880,000 cu.ft. per second.

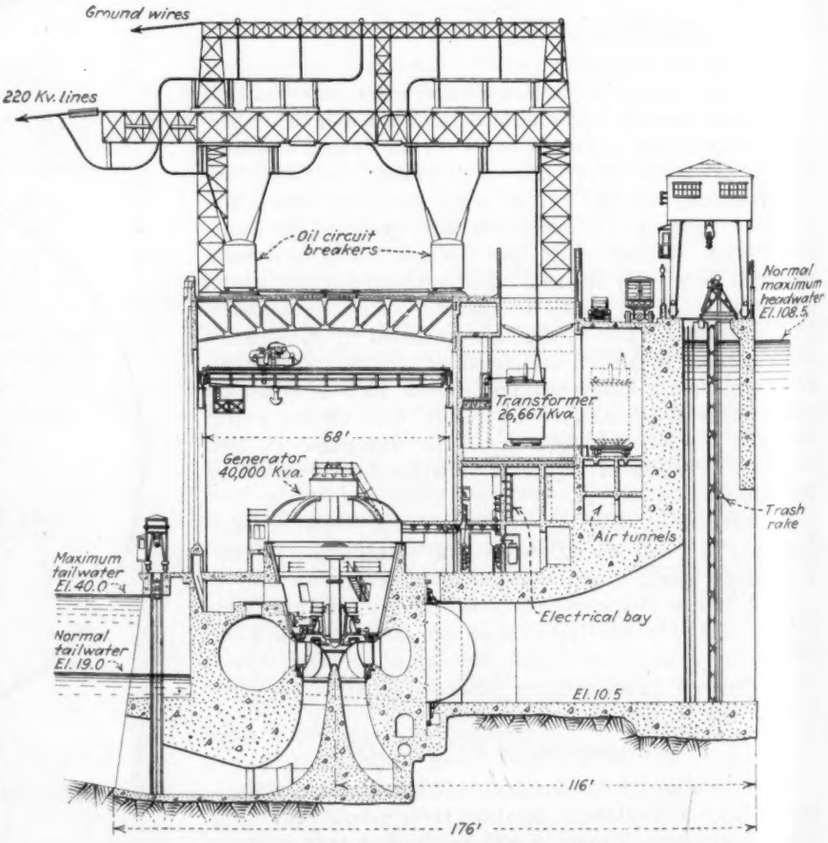
The main waterwheels, of which there are seven now being installed, are of the vertical-shaft, single-runner, reaction type. They are designed to operate at considerably higher and lower heads than normal (89 ft.) without undue sacrifice in output or efficiency. In addition to the main unit, there will be two station service units. Each main waterwheel will be direct connected to a main generator, an auxiliary generator and an exciter for the auxiliary generator. The excitation of the main generator will be obtained from a motor-generator set operated from the auxiliary generator. The main generators are rated at 40,000 kva. and 13,800 volts, the station service generators at 1,600 kva. and 480 volts and the auxiliary generators at 715 kva. and 480 volts.

The transformers, which step the generator voltage up to 220,000 volts, will be located on the roof of the station with the necessary high-voltage switch gear. The initial installation will include four 80,000-kva. banks consisting of three single-phase units. A 2,500-kva. bank of 13,800/460-volt single-phase transformers will afford auxiliary station service.

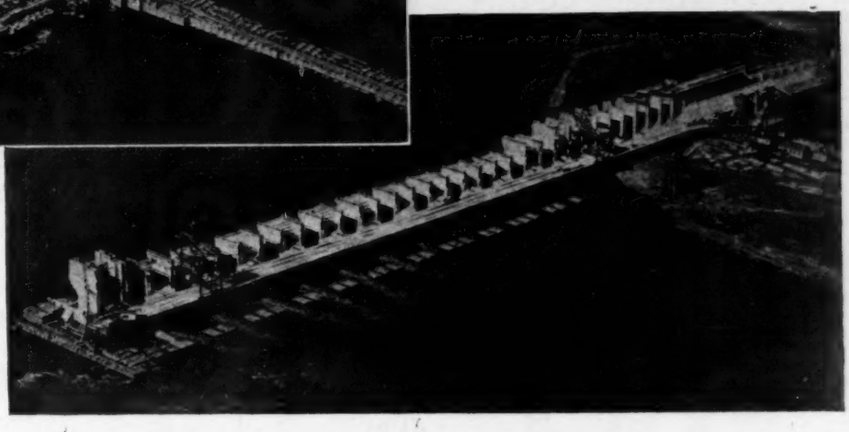
The 13,800-volt switch gear and wiring will be of the group-bay arrangement. Ultimately a low-tension ring bus may be included, but the initial installation will involve only such bus work as is required for four apparatus groups, each consisting of two generators and one bank of transformers, the groups being isolated on the low-tension side. Future groups will consist generally of four generators and two banks of transformers with connections so that one transformer bank and one generator in each group may be isolated from the others for the purpose of line testing, those remaining in service being connected in parallel on either or both of the remaining sections of high-tension and low-tension ring buses as operating conditions dictate.

The transmission cost estimates are based on seven single-circuit towers per mile spaced approximately 800 ft. apart, the towers being erected on a right-of-way 300 ft. wide, which will provide for the ultimate installation of three circuits.

Each tower line carries three conductors in a horizontal plane about 25 ft. between wires. Two ground wires are mounted on the tops of the towers approximately 25 ft. apart and 17 ft. from conductors. Aluminum conductor cable measuring about 1⅛ in. in diameter and having a steel core about ½ in. in diameter is used. The carrying capacity is equivalent to 750,000 circ.mil, copper. Each conductor will be supported by fourteen unit insulator strings about 9 ft. long.



STEP-UP TRANSFORMERS AND HIGH-TENSION SWITCHES ON ROOF OF THE CONOWINGO HYDRO-ELECTRIC STATION



OPPOSITE ENDS OF CONOWINGO DAM DURING CONSTRUCTION

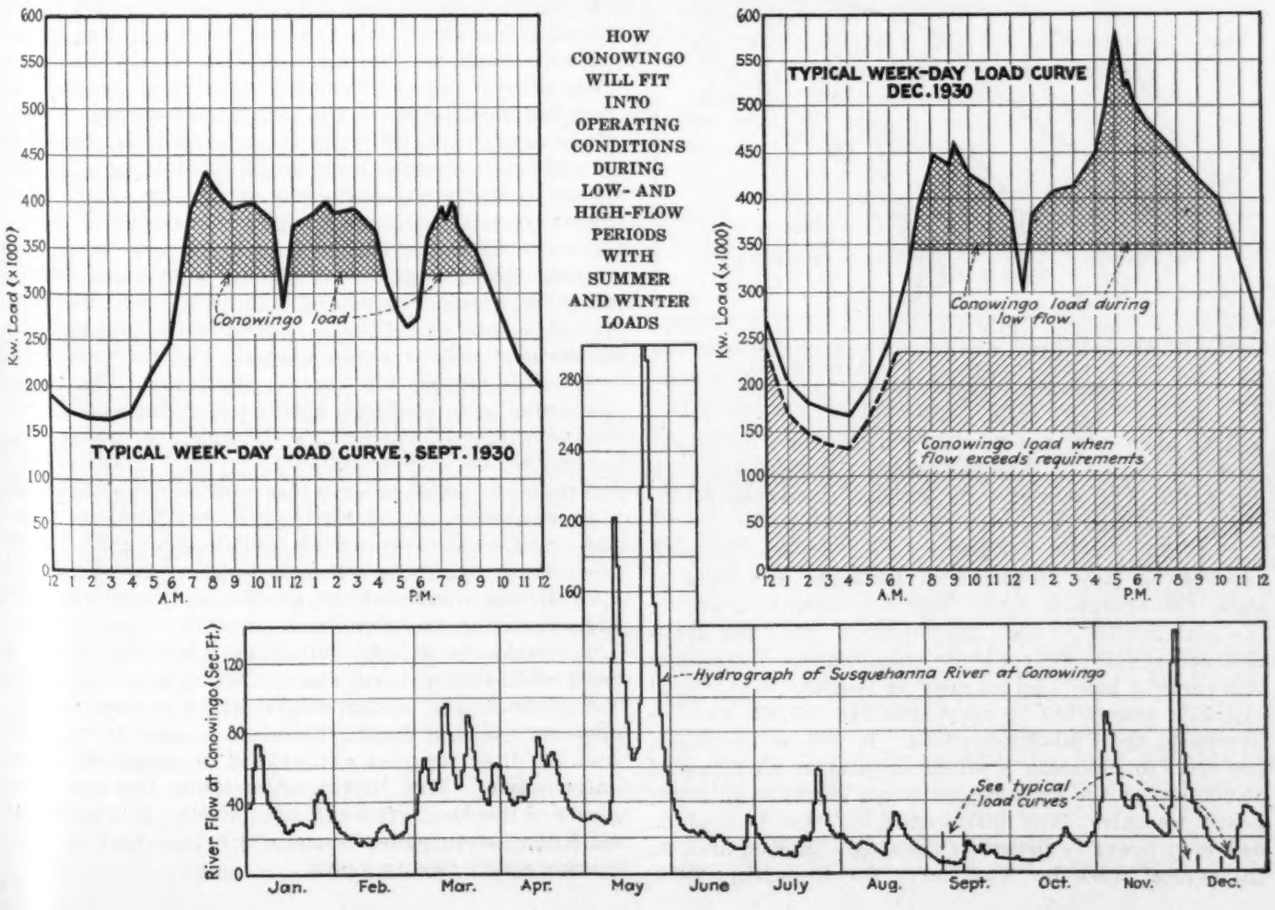
as to provide the necessary clearance over the highways.

Due to the extreme variability of the flow of the Susquehanna River, the Conowingo plant will carry either peak loads or base loads, as may be required by the river flow.

To illustrate the general method of operation, a typical hydrograph of the Susquehanna River at Conowingo and two curves of the estimated total load of the Philadelphia Electric Company System in 1930 are presented.

The week of Sept. 6 to 13, inclusive, was taken to show the operation for a low-flow condition during one

Throughout the greater part of the route from Conowingo to Philadelphia the conductors will be 65 ft. above ground at the towers and about 50 ft. at lowest point. Over fairly level country, spans of 1,000 to 1,400 ft. will be employed, whereas over broken country, spans of 1,400 to 2,000 ft. may be used. In general, the towers will be located close to points where lines cross the road so



of the summer months. For that week there is an average flow of 4,330 sec.ft., which will produce about 4,500,000 kw.-hr. delivered to the Philadelphia load for the week. By drawing a little on the pondage for the week-day peaks and allowing it to refill on off-peak periods and on Saturday and Sunday, Conowingo can deliver each week day to the Philadelphia load a total of about 760,000 kw.-hr., which will be distributed as shown by the shaded area on the typical week-day load curve for September, 1930. This will take 112,000 kw. from the peak of the week-day load. In addition, Conowingo

FROM CONOWINGO ENERGY WILL BE SUPPLIED TO PHILADELPHIA ELECTRIC COMPANY, WHICH IS TIED WITH TRANSMISSION SYSTEMS ON NORTH

will be able, with the flow shown, to take 103,000 kw. from the Saturday peak and 90,000 kw. from the Sunday peak. This will give the Philadelphia steam plants a very good load factor for the entire week.

High-Flow Operation During Peak Month.—Second, the week of Nov. 30 to Dec. 6, inclusive, was taken to show the operation for a high-flow condition during the peak month. Under this condition, when the available flow equals or exceeds the requirements, Conowingo will carry a base load as near as possible to its rated capacity, amounting to approximately 233,000 kw. delivered to the Philadelphia load. It will be necessary, however, to maintain a minimum load at all times of 35,000 kw. on the Philadelphia steam plants as an emergency measure. The distribution of this Conowingo delivered power is shown by the single-hatched area on the typical week-day load curve for December, 1930. During high flow the maximum load possible will be carried by Conowingo on Saturdays and Sundays, as well as on week days. By this method of operation about 33,400,000 kw.-hr. can be delivered to the Philadelphia load during the week of high flow.

Low-Flow Peak Month Period.—The week of Dec. 14 to 20, inclusive, was taken to show the operation for a low-flow condition during the peak month. For that week there is an average flow of 8,500 sec.ft., which will produce about 8,800,000 kw.-hr. delivered to the Philadelphia load for the week. This output will be used to take the greatest share of the peaks for each day. By drawing a little on the pondage for the week-day peaks and allowing it to refill on off-peak periods and on Saturday and Sunday, Conowingo can deliver to the Philadelphia load each week day a total of about 1,326,000 kw.-hr., which will be distributed as shown by the double-hatched area on the typical week-day load curve for December, 1930. This will take 233,000 kw., or the rated capacity of Conowingo development, from the week-day peak. In addition, Conowingo will be able, with the flow shown, to take 166,000 kw. from the Saturday peak and 140,000 kw. from the Sunday peak, giving the Philadelphia steam plants a very good load factor for the entire week.

Although this development was not started until March 8, 1926, it is expected that at least one unit will be in service about June of 1928.

Large Electrical Contracts Placed in United Kingdom

TWO important electrical orders have recently been placed in the United Kingdom, one of which is for the complete substation and line supply equipment required in connection with the electrification of the main lines of the Indian State Railways from Bombay to Igatpuri and Poona. The alternating-current three-phase supply at 95,000 volts, 50 cycles, is to be converted to 1,500 volts direct current at the substations by means of step-down transformers and rotary converters, each rotary converter unit comprising two machines in series. As there will be seven double-unit and four triple-unit stations and the number of rotary converters will be 52, with a rated output of 1,250 kw. each, the total output will be 65,000 kw. Approximately one-half the substations will be semi-automatic and the remainder will utilize supervisory control apparatus. The track-sectioning cabins will be automatic, giving indications to the attended substations through the supervisory control system.

The other large order is for a generating plant for the new works of the North British Aluminum Company, at Lochaber, near Fort William, Scotland. It will comprise five impulse water turbines of the double-jet type driving direct-current generators, which will supply current to the aluminum furnaces. Each turbine will develop a normal output of 9,000 hp. under a head of 720 ft. and will run at 250 r.p.m. Two 3,000-kw. generators in tandem will be driven by each turbine, the complete unit having therefore a capacity of 6,000 kw. A direct coupled exciter will be mounted on the same shaft. The British Aluminum Company has eleven 2,000-kw. direct-current tandem generators at its Kinlochleven power house, which have been in service for nearly twenty years.

Indoor Bus-Support Tests

Disposition of Top and Bottom Hardware, as Well as Striking Distance, Affects Flashover Value—Will Withstand Higher Cantilever Load if Applied Rapidly

By Raymond C. R. Schulze

Formerly with Duquesne Light Company, Pittsburgh, Pa.

TESTS on a large variety of indoor bus supports for 4-kv. and 22-kv. service were recently made by the Duquesne Light Company in the laboratories of the Carnegie Institute of Technology. Twenty-six different supports from seven manufacturers were involved. Certain standards for flashover voltage and cantilever strength had been set, and it was desired to find or have developed several indoor bus supports to meet the standards for these voltage ratings. These standards are as follows:

	Service	
	4 Kv.	22 Kv.
Flashover volts	40,000	95,000
Cantilever strength, pounds at center of bus	1,500	900

These standards are based on a study of operating requirements, flashover ratings of other equipment, expected maximum short-circuit current and standard bus designs.

Flashover Tests—The flashover voltage (in thousands of volts per inch) for each support tested is plotted against inches striking distance in Fig. 2. There are more points plotted than the number of different supports, since in several cases various styles of top or bottom hardware were tried on the same porcelain support. The striking distance is the minimum direct vertical distance between metal at the top and bottom of the porcelain. This figure shows quite plainly that the flashover volts per inch decrease considerably as the striking distance increases, as might be expected. It also shows that for the same vertical striking distance the flashover value may vary 25 per cent, depending on the style and arrangement of the top and bottom hardware of the support.

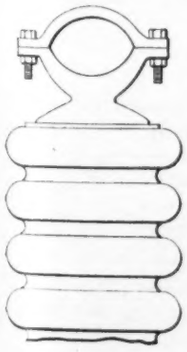


FIG. 1—TYPE OF BUS SUPPORT TESTED

Using a sub-base between the porcelain and the angle-iron framework on which the support is mounted has the effect of increasing the flashover voltage. This increase is proportionately greater as the striking distance across the porcelain decreases.

Very little variation in flashover voltage was noticed when the various types of top hardware were tried. In one case removal of the bus clamp decreased the flashover value, apparently showing that the metallic mass of the bus clamp was so arranged that it "smoothed out" the dielectric field.

There is one point about bus clamps that must be watched carefully, however. When assembling clamps of the type of Fig. 1 there is a great tendency to insert the bolts pointing down. With one support of this type,

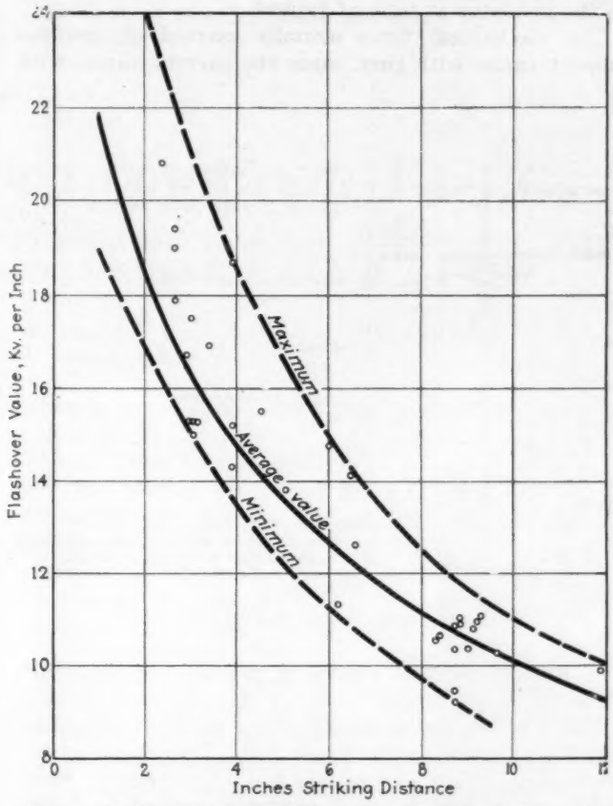


FIG. 2—AVERAGE FLASHOVER VOLTS VS. STRIKING DISTANCE FOR ALL TYPES

with a striking distance of 4 in., the flashover voltage was increased 30 per cent by pointing the bolts up, whereas with an identical support having twice the striking distance, the flashover voltage was increased 15 per cent.

One very peculiar thing happened in the case of one bus support. With all supports tested so far, the various tests were always consistent; at least three successive shots on each support were made, and the three values always agreed. An old design of one particular type was tested and showed the usual consistent values. A new support, identical in external appearance with the old support, was tested and was found to have an initial flashover voltage of 150 per cent of that of the old support. On successive shots this flashover voltage quickly dropped to a more or less constant value of about 125 per cent of that of the old support. After standing five minutes or so the flashover voltage would come back to its 150 per cent value. This behavior was well established by tests on a number of new supports. This appears like some kind of electrical fatigue in the porce-

lain. No explanation was advanced at the time of the tests, and none is offered now.

Cantilever Tests.—After the flashover tests, certain of the bus supports were taken to the materials laboratory for tests of cantilever strength. A diagram, showing the layout for this test, is given in Fig. 3. The set-up for each test was O.K.'d by the manufacturer's representative, if present, before beginning to apply any load to the insulator. The dead weight of the base, insulator, etc., was noted, and a gradually increasing load was applied to the bus support. This load was increased at a uniform rate until the bus support failed or it became advisable to stop the test. The dead weight was then subtracted from the gross weight to give the net weight on the insulator at time of failure.

The mechanical force actually exerted on the bus support varies with time, since the current varies with

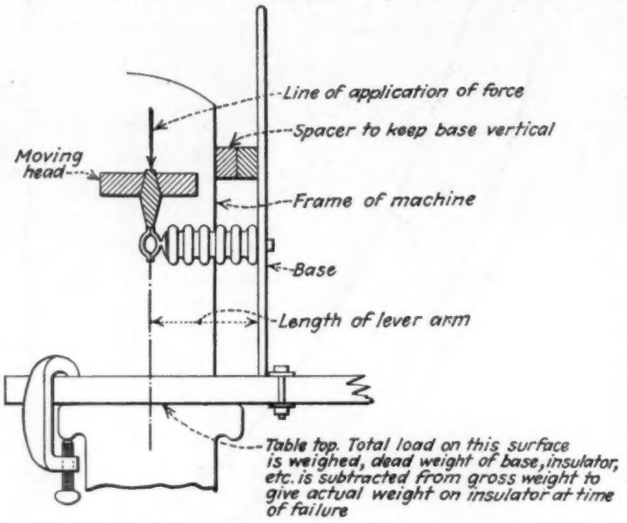

Line of application of force
Spacer to keep base vertical
Moving head
Frame of machine
Base
Length of lever arm
Table top. Total load on this surface is weighed, dead weight of base, insulator, etc. is subtracted from gross weight to give actual weight on insulator at time of failure

FIG. 3—EQUIPMENT FOR CANTILEVER TESTS

time during the first second or more. The maximum actual variation is shown in Fig. 4.

Fig. 5 shows the variation of the stress in the porcelain due to actual conditions or test. Two forms of test are shown—either a cantilever test, the set-up for which is shown in Fig. 3, or a suddenly applied load test. Theoretically, the suddenly applied load test is performed by supporting a definite load just above the insulator to be tested, and then quickly removing the support. In this way the load is suddenly applied, its velocity at the time of application is zero, and the stress in the insulator is twice that if the load were applied gradually. The specimen under test will oscillate until the stress in it reduces to the gradually applied load value. An attempt was made to perform tests of this kind, but the set-up required was too elaborate.

No suddenly applied load tests were performed. An examination of Figs. 4 and 5 will show that if the cantilever strength required is based on the initial rush of current and the bus support withstands this mechanical load, then the bus support will have a high factor of safety.

WITHSTANDS LARGER LOAD IF APPLIED RAPIDLY

One indeterminate feature of cantilever tests should be mentioned here. The maximum load that a porcelain bus support will stand varies considerably with the speed of application of the load. If the load is increased rapidly to a maximum value and then released, the support will stand a higher load than if it were applied slowly. In one case on test, the support broke while the load was being held constant for a short time.

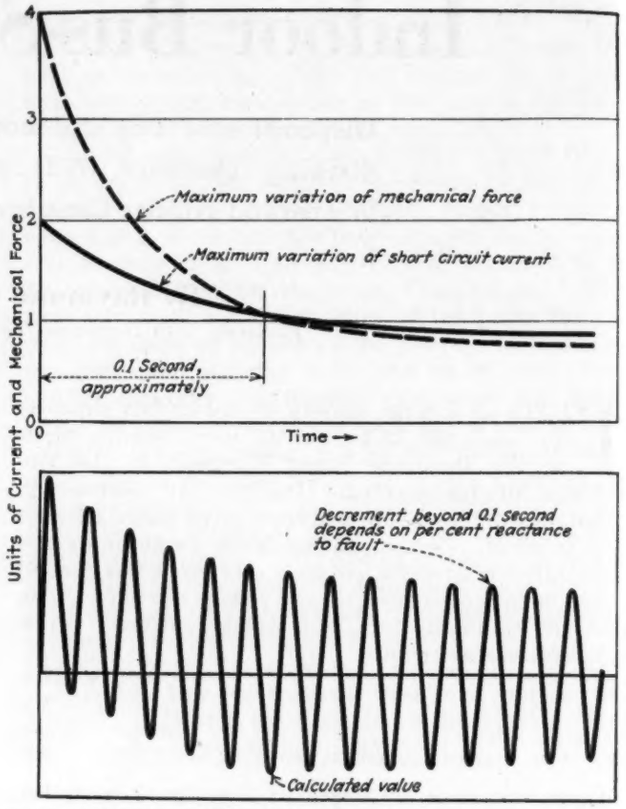

Units of Current and Mechanical Force
Maximum variation of mechanical force
Maximum variation of short circuit current
0.1 Second, approximately
Time
Decrement beyond 0.1 second depends on per cent reactance to fault
Calculated value

FIG. 4—ACTUAL MAXIMUM VARIATION OF MECHANICAL FORCES

Mechanical Tests.—The force exerted on conductor supports in pounds per foot length of bus (the conductors of the bus being mounted in a plane) is given by the following formula, taken from a manufacturer's catalog:

$$F = \frac{0.27 \times (kva)^2}{A \times V^2 \times Z^2}$$

where F = force in pounds per foot of bus.
kva = normal rating of generating stations on system.
A = distance between buses in inches.
V = line voltage.
Z = impedance in per cent, expressed in decimals, to point of short circuit.

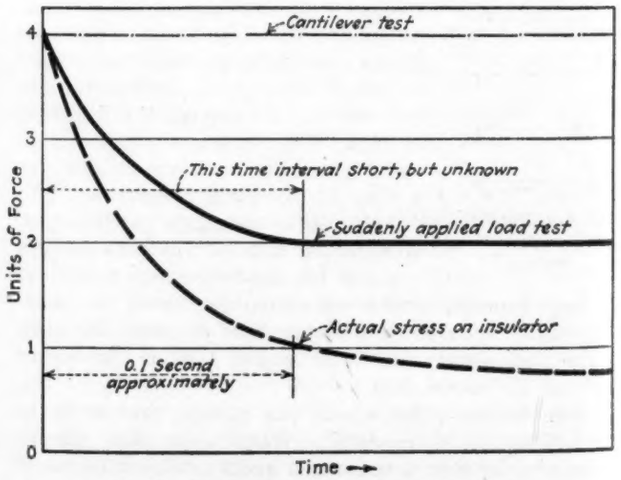


FIG. 5—COMPARISON OF METHODS OF TEST

For fixed conductor spacing and voltage, this formula reduces to

$$F = a\ constant \times (short\ circuit\ current)^2.$$

There may also be a considerable variation in the results of two tests run on bus supports of the same kind under as nearly as possible the same conditions. Considering the possibilities of error in the results, where only one support of a given type is tested, it is safer to assume the test value to be high and that some percentage of it, say 75 per cent, is closer to the minimum cantilever strength to be expected.

Any bus support having a single bolt mounting may fail by having the bolt stretch, the porcelain remaining intact. When the hardware is attached to the porcelain by means of a thimble insert cemented into a hole better results are obtained with a sanded surface hole.

Mechanical Features.—In order to give each manufacturer proper credit for the constructional features of his product, each bus support was analyzed in accordance with this outline:

Type of porcelain, glaze, diameters, heights (one piece), method of attaching hardware, base material used (interchangeable with other makes, type used on test, regular styles, finish used), top hardware (material used, interchangeable with other makes, type used on test, regular styles, finish used), novel features.

The interchangeability of various porcelains and bus clamps received particular attention. Another important design point is the limit of adjustment of the line of the bus clamp. Some are fixed, others have a limited angle of adjustment, and others are continuously adjustable.

Electrolytic Gas to Enrich Low-Grade Fuel Gas

Proposes Utilizing Rhode Island Coal for Generation of Power and Water Gas—Electrolytic Gases Made from Off-Peak Power—Relief Gas Holders and New Type of Gas Making

BY FARLEY G. CLARK
Consulting Engineer, Toronto, Ont.

THE possibility of economically using Rhode Island coal is an invitation to controversy. A fair and open-minded discussion of this question can do no harm and may prove of great benefit.

The coal varies greatly in quality, both as to the density—that is to say, the physical and chemical condition of the carbonaceous material—and as to the nature and amount of the ash—that is to say, the gangue matter. Much of the gangue matter is in so intimate association with the carbonaceous matter that complete separation by anything less than combustion or smelting is out of the question. It is reasonable to expect that fine grinding and processing by froth flotation or according to the Trent process, which I understand is being experimented with, will materially reduce the ash content of the raw material. A reduction of the ash content means an increase of the carbon content, but may not be a very material improvement, for the coal is practically devoid of combustile volatile matter and is, moreover, not a true anthracite but a form of carbon that may perhaps best be called a graphitic anthracite. There are undoubtedly very great deposits which will average 80 per cent of carbon as mined and when concentrated the coal may contain from 85 to 90 per cent of carbon.

My proposal has no relation to the attempts to prepare this coal for domestic use. My concern is its use as a fuel for the production of electric energy and heating gas on a large scale. In this proposal the removal of the ash is of practically no more importance than the removal of ash from bituminous coal before it is fired.

PULVERIZED COAL FOR GAS MAKING

The coal used for steam production will have to be pulverized, but the practice of burning pulverized coal is no longer an untried process.

The coal used for gas making need not be finely ground unless there is a need for ash removal which is not foreseen. The gas made from the coal will be water gas and it will be made in a continuously operated water gas generator depending upon oxygen instead of air. The gas made in this generator will be free of nitrogen and will contain but 1 or 2 per cent of carbon dioxide. Its composition will be approximately 70 per cent carbon monoxide and 30 per cent hydrogen. Additional hydrogen from another source will be added to produce a salable mixture, which will be 50 per cent carbon monoxide and 50 per cent hydrogen.

The foregoing has been a discussion of methods without reference to economics, and as my proposals from now on may at first thought appear to run counter to the laws of conservation of energy, I may as well state my paradox before proceeding with the discussion.

The thermal efficiency of gas making varies from 40 to 80 per cent, depending upon types of apparatus used and their combinations.

The thermodynamic efficiency of producing electric energy from coal may be about 20 per cent in a large modern power plant operating at very high load factor, but will not exceed 15 per cent when the load factor is less than 50 per cent.

Notwithstanding this, I propose to use approximately one-half of the energy generated in the steam plant to produce gas in the gas plant and to effect very material savings thereby. If the saving is real, the profit can be found no matter how the books are kept, so I will outline the proposed scheme of operations in my own way.

I will assume a 200,000-kw. steam plant suitably located with respect to the coal mine, condensing water and feed water. From this plant, used in connection with an adequate transmission system, approximately 700,000,000 kw.-hr. can be sold annually at an average cost to the customer of 7.5 mills per kilowatt-hour. Of this we shall take the generating cost, including fixed charges and overhead, at 5.5 mills per kilowatt-hour.

The above output produces a 40 per cent annual load factor.

Production of an 80 per cent load factor will require the generation and disposal of an equivalent quantity of energy. This second 700,000,000 kw.-hr. will be used by the gas plant at the increment cost of generating the additional energy, for the capital investment is in no way increased on this account.

The pro rata cost of 1,400,000,000 kw.-hr. would be approximately 4.5 mills, but the increment cost will not exceed 3.5 mills. We have:

700,000,000 kw.-hr. for transmission at 5.5 mills
700,000,000 kw.-hr. for gas making at 3.5 mills
or 1,400,000,000 kw.-hr. total at an average of 4.5 mills.

The cost of transmission to an average distance of 40 miles but based on 200 miles of duplicate circuits sufficient for the total output of the plant will be 1.5 mills, or a total of 7 mills for the energy delivered to the distant consumers.

With Rhode Island coal containing 80 per cent of carbon available at the plant at $3.50 per net ton, the coal cost per kilowatt-hour will be 2 mills at 80 per cent load factor and 2.35 mills at 40 per cent load factor. As the coal cost will, in a case such as this, approximate two-thirds of the operating cost, making that cost 3 mills per kilowatt-hour, we are favoring a profit to the steam plant if we take the increment cost of the kilowatt-hours delivered to the gas plant at 3.5 mills.

ELECTROLYTIC PLANT SMOOTHES OUT STATION LOAD

My problem is to provide equipment to take and use the kilowatt-hours when they are available without in any way disturbing the functioning of the plant for the benefit of the consumers on the transmission line. I do this by making use of electrolytic apparatus, the operation of which in taking energy is exactly similar to the charging of large storage batteries when the rate of charging is made to vary with the rise and fall of the demand for power for other uses.

These electrolytic cells are used to decompose water into its elemental gases, oxygen and hydrogen, and possess the characteristic of increasing energy efficiency with decreasing current input.

They can be automatically controlled to vary the energy input with the variations of demand incident to the transmitted power so that the load on the plant will be approximately constant.

The electrolytic cells will have a current range from 1,000 to 15,000 amp., with an energy efficiency difference of 27.5 per cent.

The decomposition of water depends upon the current used and the length of time it is used—ampere-hours. The efficiency therefore can be expressed as changes of voltage.

The plant needed will consist of a substation with alternating current to direct current converting apparatus having a capacity of about 100,000 kw. The direct current is led directly to the cells and the gases from the cells are led to gas holders, which are the balancers between the gas-making rate in the electrolytic plant and the gas-making use in the gas plant.

The floor space occupied by the cells will be about 25 per cent greater than that needed for the converting apparatus.

The average voltage of the cells in this plant will, because of the variable rate of supply, be about 2.1 volts and the cost of the gases produced will not exceed 37.5 cents per 1,000 cu.-ft. This cost includes everything except profit. The capital costs are taken at 15 per cent per annum.

Two-thirds of the electrolytic gas is hydrogen and one-third oxygen. Anticipating the proof of the value of oxygen in the manufacture of uncarburetted water gas, I shall here state that it should be charged for at a rate in excess of 60 cents per 1,000 cu.ft. Taking its value at 60 cents per 1,000 cu.ft. will mean that for each 3,000 cu.ft. of gas made at a cost of $1.125 we will receive 60 cents for the 1,000 cu.ft. of oxygen, so that the 2,000 cu.ft. of hydrogen can be disposed of at 52.5 cents, or at the rate of 26.25 cents per 1,000 cu.ft.

In New England, coal or coke suitable for water gas manufacture will cost from $8 to $15 per ton. Based upon coke at $8 per ton, uncarburetted water gas will cost 25 cents per 1,000 cu.ft.

Uncarburetted water gas has a heat unit value of 300 per cubic foot. Hydrogen has a heat unit value of 320 per cubic foot. Hydrogen at 26.25 cents per 1,000 cu.ft. is a more valuable gas than the water gas at 30 cents per 1,000 cu.ft.

Rhode Island coal cannot be used in the intermittent process of making water gas. It will serve no useful purpose therefore to compare the intermittent and the oxygen blast continuous process with this coal as the fuel.

The oxygen-fed generator will require about 30 lb. of carbon per 1,000 cu.ft. of gas. It will take about 250 cu.ft. of oxygen and a little more than 16 lb. of water, only a part of which need be steam, on account of the necessity for temperature control due to the use of oxygen.

The operating cost, including the standard allowance for water gas production, will be approximately 25 cents per 1,000 cu.ft. for a 70-30 gas of 335 B.t.u. per cubic foot, as compared with the gas of 300 B.t.u. per cubic foot.

As each cubic foot of oxygen produces 4 cu.ft. of water gas, of which 30 per cent is hydrogen, and as there are 2 cu.ft. of hydrogen for each cubic foot of oxygen produced electrolytically, it follows that by mixing the electrolytic hydrogen with the water gas we have a 50 per cent increase of gas, which changes from 70 per cent carbon monoxide and 30 per cent hydrogen to 47 per cent carbon monoxide and 53 per cent hydrogen.

Letters from Our Readers

Facilities for Oiling Domestic Refrigerators Are Criticised

To the Editor of the ELECTRICAL WORLD:

The article on refrigerators in your issue of July 30 by George A. Marshall is too good an opening to miss; therefore I should like to call disrespectful attention to the matter of oiling refrigerator and other domestic motors. We have a very satisfactory outfit in all respects except that of oiling, so this is not a kick at anything except the idiocy of expecting householders to get enough oil through the miserable little flap covers of a motor. One bearing is carefully tucked up close to the coils, probably "to make it harder." A sign came with the equipment, and this sign was none too emphatic as to whether oil was wanted once a week or once a month, or whether one drop from an infant-size can would be enough or not.

Our house is full of these contraptions for the, at least partial, benefit of the electric company, and as an expert customer I think the installation and servicing of domestic equipment are in about the prenatal stage.

Ridgewood, N. J. R. D. COOMBS.

Central Station and Industrial Practice

Disconnects Interlocked for Unit Operation

BY V. P. BRODSKY
Pittsburgh Branch, Byllesby Engineering & Management Corporation

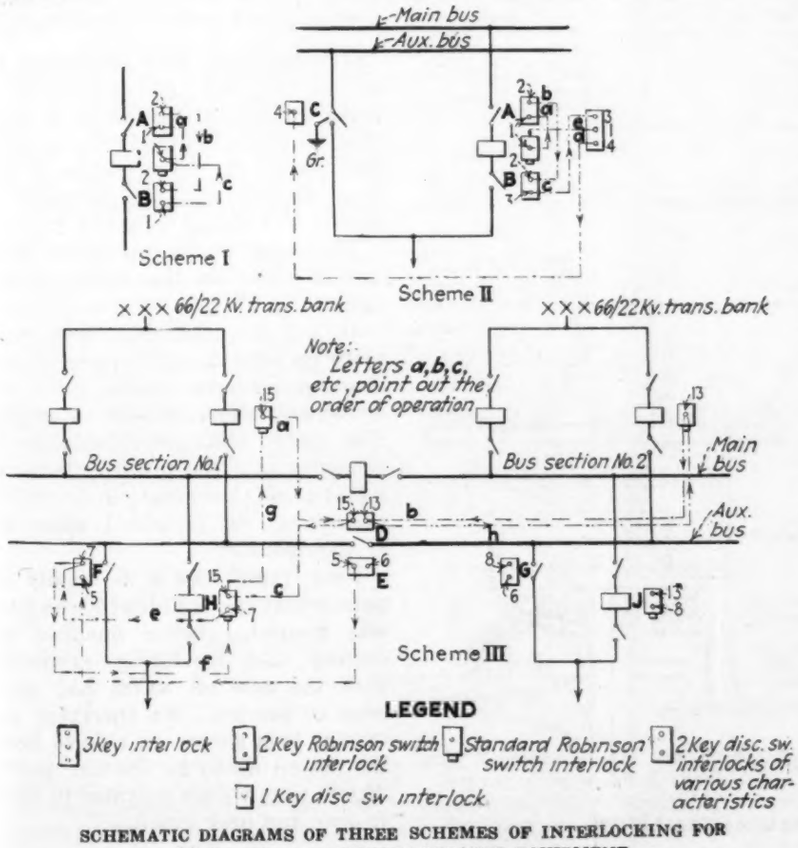
ENGINEERS and operators of the Duquesne Light Company have evolved a scheme for interlocking simultaneously operated disconnects on the 22-kv. bus and feeder circuits of the Dravosburg substation, near Pittsburgh.

All the 22-kv. circuit breakers are interlocked with their respective disconnects by means of two-key, shaft-type locks in such a way that the breaker, if necessary, can be closed for maintenance purposes with both sets of disconnects locked open. The simultaneously operated grounding blades of the 22-kv. auxiliary bus disconnects on the outgoing lines are interlocked with the line side disconnects on the main bus by means of shaft-type locks and an auxiliary key box in such a way that the grounding blades can be closed only when the disconnects are locked in the open position.

TWO-KEY SWITCH INTERLOCK SPECIALLY DESIGNED FOR REQUIREMENTS OF DUQUESNE LIGHT COMPANY

The auxiliary bus disconnects on the outgoing circuits interlock with the main bus breaker on the same feeder, with the auxiliary bus transformer breaker on the same section of the bus and with the bus tie disconnects in such a way that in order to operate the auxiliary bus disconnects on a feeder the feeder breaker must be in a closed position and the auxiliary bus tie disconnects must be opened.

The special type of interlocks necessary for the transfer of a circuit from the main to the auxiliary bus is similar to the Cory Type B-986, but is so arranged that one of the keys can be withdrawn only when the other key is in and when the breaker is closed.



SCHEMATIC DIAGRAMS OF THREE SCHEMES OF INTERLOCKING FOR 22-KV. BUS AND CIRCUIT BREAKER EQUIPMENT

Transformer Oil Sludge Tests

THAT the cooling and insulating properties of transformer oil which has been operated at sufficiently high temperatures to cause sludging can be fully restored by properly filtering the oil every three or six months is shown by extensive tests recently completed by H. W. Moore, superintendent the electrical construction and maintenance department of the Dayton (Ohio) Power & Light Company. It was desired to ascertain definitely the effect of oil sludging upon the dielectric strength of the oil, and for the purpose of the test three transformers were chosen that had been worked under particularly severe conditions. Mr. Moore describes the methods of conducting the tests and the results as follows:

We selected three 1,000-kva. air-cooled transformers, high voltage being 6,600 to low voltage of 2,300, located inside of one of our substations. We had been working them very severely for the last six months, the temperature of the oil running as high as 90 deg. C. After getting over the peak period of the winter we decided to make some tests on this oil, realizing the severe work that it had been called upon to function under and knowing that we had never definitely decided among ourselves when the oil, even though the dielectric strength is high, should be discarded.

It was thought probable, because of this high heat to almost burning

temperature, that the oil would sludge much more quickly than if it had been worked in a more reasonable temperature. The oil upon removing from the transformer case was found to be black and smelled as if it had been removed from a transformer that had been completely burned out. For any amount we took we would immediately find a sludge solution being formed in the bottom of the test bottle. The transformer coils and the bottom of the transformer case were covered 2 or 3 in. deep with black sludge which forms after the oil has been used at this high temperature for some time.

However, upon testing the oil, it was found that the dielectric strength was 30,000 volts. This was obtained by taking an average of four tests and using 1-in. disk electrodes set at 0.1 in. We then proceeded to make a chemical test on it in order that we might definitely decide as to the quality of this oil after it had been filtered and the particles of carbon and sludge removed from it.

The result of the tests after filtering is given in the accompanying table.

It will be seen that tests were made on both the old, burned oil and also a comparative test on brand new oil which had never been in service. The sludge tests were made in accordance with the revised "Mitchie" method as described in A.S.T.M. procedures, vol. 23, part 1, pages 451 to 453 inclusive.

From these tests it is readily apparent that the old oil after filtering was somewhat better qualified for cooling and insulating properties than the new oil which had never been in service. We therefore feel that so long as we are able to bring the old oil up to an average test of 30,000 volts we are justified in using it over and over again.

COMPARATIVE TESTS OF TRANSFORMER OIL

	"New Oil"	"Used Oil" (After Filtering)
Sludge Test:		
Sludge insoluble in benzine, per cent	2.44	1.90
Gummy deposit soluble in benzol, per cent	0.11	0.11
Total sludge, per cent	2.55	2.01
Dielectric Strength	Volts at	Puncture
Test No. 1	24,500	38,000
2	20,000	33,000
3	27,000	27,000
4	26,000	36,000
5	26,500	26,000
Average	24,800	32,000
6	22,500	34,500
7	24,000	34,000
8	27,000	37,000
9	27,500	28,000
10	22,000	29,000
Average	24,600	32,500
11	23,000	32,000
12	23,500	37,000
13	27,000	33,000
14	26,000	28,000
15	24,500	29,000
Average	24,800	31,800
Grand average	24,700	32,100

Rural-Line Specifications—XII

Of the Wisconsin Power & Light Company

Transformer Installations and Services

IN MAKING transformer installations the arresters are not placed on cross arms, as is usual for distribution work, but are attached to the pole in order to make the wiring simpler. The connection to the phase wire should be made with an approved hot-line clamp. This permits adding or changing transformers and arresters without cutting out the line. The connection to the neutral need not be provided with a hot-line clamp, although its use for this purpose is permissible.

The services are supported by a three-point spreader bracket. No fuse is to be installed in the neutral lead. In localities where lightning is severe, choke coils may be included in the installation as indicated by dotted lines. It is important that all transformer installations be made in a neat and workmanlike manner.

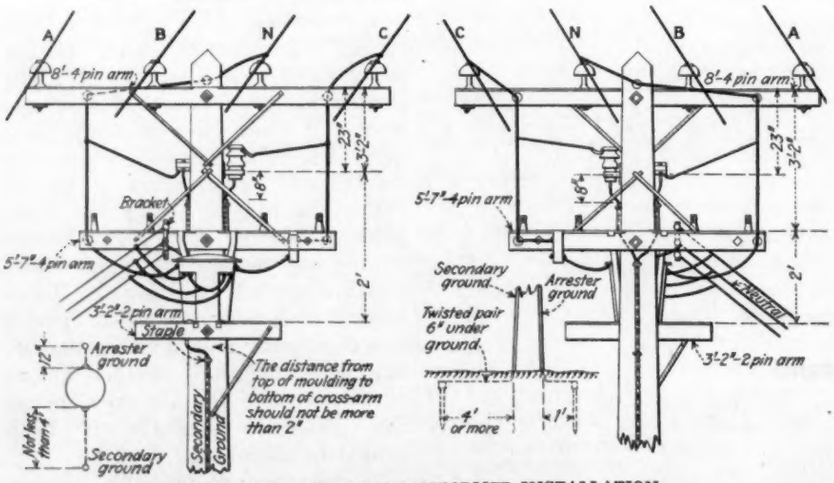
Services.—All services are to be three-wire 115/230 volts. The capacity of the service wires is not to be less than that of a No. 6 copper. All service wires are to have a standard triple-braid weatherproof covering.

Where two or more customers are supplied from the same transformer and a secondary line is necessary and attached to the poles supporting the primary supply, the material of the secondary conductors should be the same as the primary conductors, and in no case are they to be smaller than No. 6 copper or No. 4 A.C.S.R. When located outside of corporate limits they may be bare.

CAPACITY OF TRANSFORMER FUSES—NO. 7

Voltage Single Phase	Kilovolt-Ampere Capacity of Transformers											
	1½		3		5		7½		10		15	
	Load, Amp.	Fuse, Amp.	Load, Amp.	Fuse, Amp.	Load, Amp.	Fuse, Amp.	Load, Amp.	Fuse, Amp.	Load, Amp.	Fuse, Amp.	Load, Amp.	Fuse, Amp.
2,300	0.81	3	1.6	5	2.7	10	4.1	15	5.4	20	8.1	25
6,600	0.28	3*	0.56	3	0.94	5	1.4	5	1.8	8	2.8	10
Voltage Three Phase	Kilovolt-Ampere Capacity of Bank											
	15		22½		30		45		75		112½	
	Load, Amp.	Fuse, Amp.	Load, Amp.	Fuse, Amp.	Load, Amp.	Fuse, Amp.	Load, Amp.	Fuse, Amp.	Load, Amp.	Fuse, Amp.	Load, Amp.	Fuse, Amp.
4,400	2.7	10	4.0	15	5.4	20	8.1	25	13.5	50	20	60
11,400	0.94	3	1.4	5	1.8	8	2.8	10	4.7	20	7.0	25

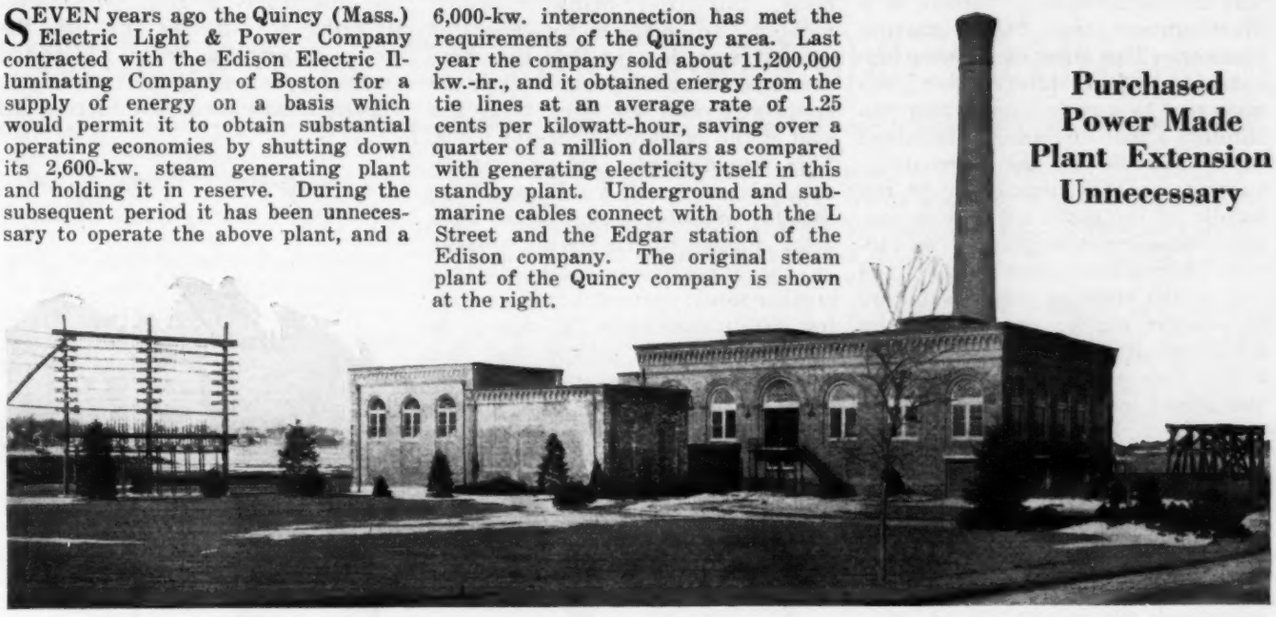
* The ampere capacity of fuse for 1½-kva., 6,600-volt transformers may be reduced to 2 amp. if this size use is found to operate satisfactorily.



FRONT AND BACK OF TRANSFORMER INSTALLATION

Purchased Power Made Plant Extension Unnecessary

SEVEN years ago the Quincy (Mass.) Electric Light & Power Company contracted with the Edison Electric Illuminating Company of Boston for a supply of energy on a basis which would permit it to obtain substantial operating economies by shutting down its 2,600-kw. steam generating plant and holding it in reserve. During the subsequent period it has been unnecessary to operate the above plant, and a 6,000-kw. interconnection has met the requirements of the Quincy area. Last year the company sold about 11,200,000 kw.-hr., and it obtained energy from the tie lines at an average rate of 1.25 cents per kilowatt-hour, saving over a quarter of a million dollars as compared with generating electricity itself in this standby plant. Underground and submarine cables connect with both the L Street and the Edgar station of the Edison company. The original steam plant of the Quincy company is shown at the right.



Preventing Synchronous Outages During Voltage Dips

WHEN driving machinery by synchronous motors, it is desirable to minimize shutdowns due to voltage dips. This problem was discussed at a recent meeting of the Interstate Power Club and the New England Association of Central-Station Power Engineers by E. L. Fleming, of the Public Service Electric & Gas Company, Newark, N. J. In view of the broad application of the methods described, the following notes are presented:

In case either a starting compensator or oil switch with auto-transformer is used for the synchronous motors, the overload releases should be set high enough so that the increased current due to line dips will not cause them to shut down the motors. There should also be a liberal time element in both the overload and the no-voltage releases before they will act under any conditions of low voltage.

A scheme particularly adapted to refrigerating plants is shown in an accompanying diagram (Fig. 1). Here the low-voltage release coils, which are ordinarily wound for alternating-current operation, are replaced by direct-current coils energized from the direct-current end of the motor-generator set furnishing excitation to the synchronous motor. This installation was made in the plant of one customer who had previously suffered severely due to motors stopping because of dips in voltage, aggravated in summer by lightning storms. During the summer of 1926, after the installation was made, there was no interruption in this plant, although there were several voltage dips due to transmission disturbances.

This scheme has also been applied (Fig. 2) using a storage battery of 12 volts to supply the direct current instead of direct current from a motor-generator set.

Extended tests have been made with connections as shown (Fig. 3) upon a 300-hp. synchronous motor driving a two-cylinder ice machine. The exciter was started by a Type "CR" General Electric starting compensator. The synchronous motor

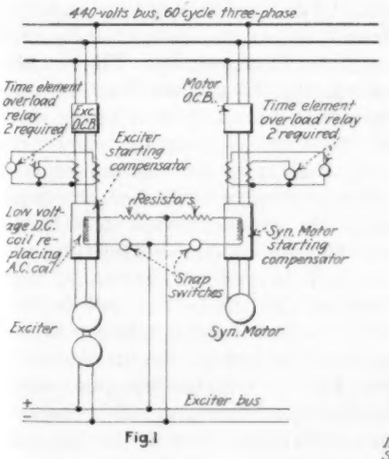


Fig. 1

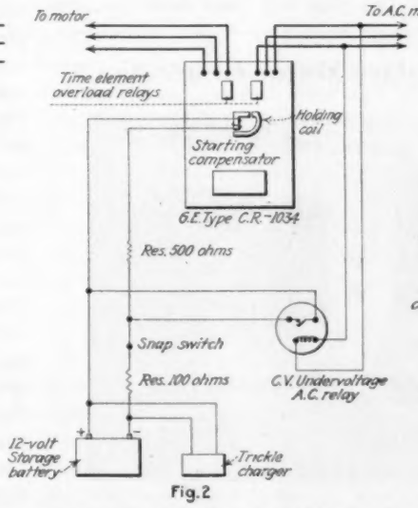


Fig. 2

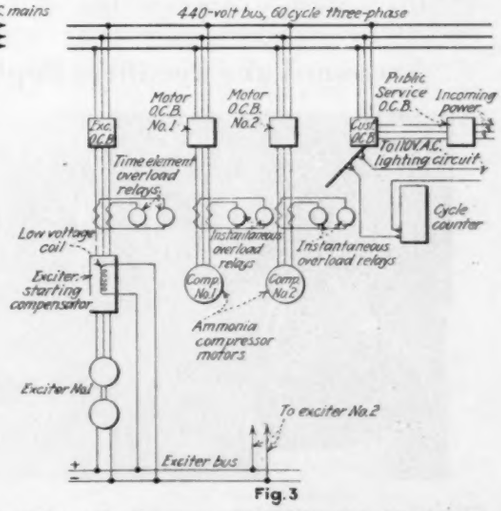


Fig. 3

FIG. 1—WIRING DIAGRAM FOR DIRECT-CURRENT LOW-VOLTAGE COIL FOR DIP VOLTAGE PROTECTION OF SYNCHRONOUS MOTORS

FIG. 2—SCHEME FOR OBTAINING LOW-VOLTAGE PROTECTION FOR SYNCHRONOUS MOTORS WITHOUT THE USE OF A MOTOR-GENERATOR SET

FIG. 3—TEST CONNECTIONS, USING A DIRECT-CURRENT LOW-VOLTAGE COIL FOR THE PROTECTION OF SYNCHRONOUS COMPRESSOR MOTORS

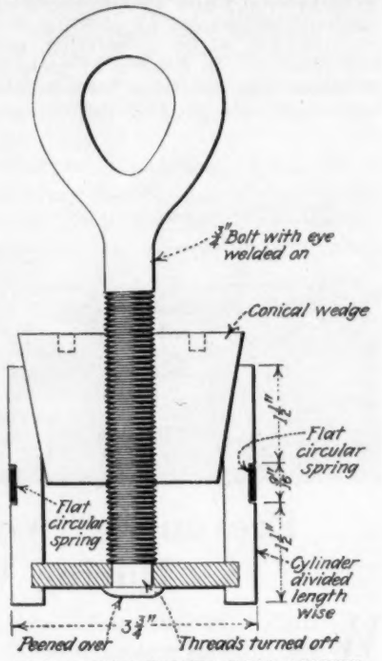
was started on reduced voltage by a Westinghouse type "QF" starting breaker. The time of alternating-current voltage interruption was measured by a cycle counter operated through a pair of contacts connected to the handle of the alternating-current machine breaker or to the handle of the main alternating-current transformer breaker. The 440-volt, alternating-current, low-voltage coil in the starting compensator on the exciter starter was replaced by a 125-volt, direct-current, low-voltage coil. This coil was excited from the direct-current exciter bus in the station. Potential measurements were taken across the direct-current low-voltage coil by a portable voltmeter, and all other measurements were made on meters on the customer's switchboard.

The object of the tests was to investigate the possibility of eliminating the improper operation of the alternating-current low-voltage coil on the exciter compensator by replacing this coil with a direct-current coil fed from the exciter bus. The theory was that the inertia of the motor-generator set would be sufficient to hold in the low-voltage coil armature until alternating current was restored to the motor-generator set and thus hold the exciter on the line. The tests showed that the direct-current coil used in this way accomplished the desired object. The readings and performance of the equipment showed that the voltage may even go to zero for about 2.5 seconds and if restored to full value will not interrupt the direct-current supply. Moreover, the no-voltage protection on the motor-generator set is still secured and is operative in about 20 seconds of time delay, this time being measured without load on the motor-generator set. It was thought that this time would be about ten seconds when the motor-generator set is carrying the load of the synchronous motor fields. This was deemed very satisfactory for this application. It was also thought probable that a slight time delay applied to the circuit breaker on the synchronous motor-starting breaker would prevent it from operating too quickly when full voltage is restored after a dip and that this would hold these motors on the line even for very severe dips if the voltage is restored to normal within two seconds.

Replacing Boiler Tubes

By E. H. KIRCHNER
Chief Engineer Winona (Minn.) Plant
Mississippi Valley Power Company

PUTTING a new tube in a Stirling boiler or in any other boiler in which the tubes are long is often a disagreeable job. After the defective tube has been removed and the new one has been carried into the boiler there yet remains the job of getting the two ends of the new tube into the drums. When the tube bank is perpendicular, or nearly so, the usual procedure is for the new tube to be pushed up from the bottom. It frequently happens that the top of the tube will strike adjacent tubes or the back wall of brickwork and will bring down a shower of heavy dust and ash on the man who is pushing the tube up. If a rope is let out of the hole in the top drum and tied around the tube to haul it into place, the top end of the tube cannot be inserted into the hole until the rope has been removed and the tube pushed in from the outside. In order to simplify this job the writer inserts the device illustrated in the upper end of the boiler to be replaced, attaches a rope thereto and

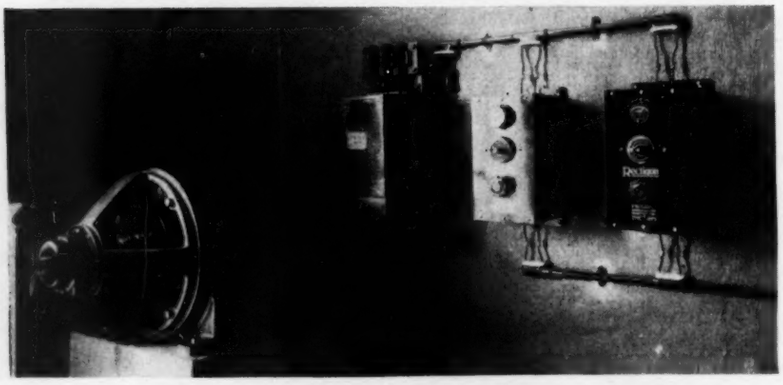


BOILER TUBE HOLDER THAT ASSISTS INSERTION IN DRUMS

pulls it through the hole in the top drum. By means of the handle afforded by the eye rod the upper end of the tube can be held in place while the other end is being expanded in the lower drum. After this has been done the eye block is removed and the upper end of the tube secured in place.

The device consists of a cylinder split in three longitudinal sections, held together by a flat circular spring but capable of being expanded by a conical wedge operated by the eye-bolt. The accompanying drawing clearly shows the construction and operation of the device. The circular spring is nothing more than one complete turn taken from a heavy clock or phonograph spring. The rod down the center is a standard ¾-in. bolt with an eye welded on the blank end. To use the device it is thrust into the end of the boiler tube and the bolt turned up by hand. The lower end of the bolt is free to turn in the bottom holding plate. It may happen that when the device is in use the bolt will become jammed in the holding plate and will refuse to turn. For this reason the top surface of the truncated cone wedge is drilled with two diametrically space holes so that the cone may be turned back on the bolt with a two point wrench.

Vacuum-Tube Rectifiers Replace Motor-Generator



THE motor-generator set shown has been displaced by two garage-type rectifiers operating in series to supply the necessary 125-volt charging current. Full details of this method of charging station storage batteries were published in the ELECTRICAL WORLD for Feb. 13, 1926, page 357.

Commercial Activities and Public Relations

Raising Residential Sales to 588 Kw.-Hr. a Year

AN INCREASE of 100 per cent in the number of kilowatt-hours sold per customer is the record achieved by the Northern Ohio Power & Light Company over a ten-year period. During the year 1926 29,127,159 kw.-hr. was sold to an average of 49,605 residence customers, or 588 kw.-hr. per customer per year. These sales include consumption by ranges and other residential devices. The average use, excluding ranges, which add an average of 1,980 kw.-hr. a year, is 516 kw.-hr. per customer.

The growth of residential sales of electricity by this company is attributed largely to the promotional type of rate computed, on a monthly basis, as follows:

City rate: 8 cents per kw.-hr. for the first 15 kw.-hr. 5 cents per kw.-hr. for the next 45 kw.-hr. 3 cents per kw.-hr. for all over 60 kw.-hr.

For the suburbs: 9 cents per kw.-hr. for the first 15 kw.-hr. 6 cents per kw.-hr. for the next 45 kw.-hr. 3 cents per kw.-hr. for all over 60 kw.-hr.

Rural residence lighting rate is the same as city residence lighting rate with an added fixed charge of $1 per month.

Rural residence lighting rate is the same as the city residence lighting rate with an added fixed charge of $1 per month.

The average earned rate on city service is about 5½ cents per kilowatt-hour; on suburban and rural service combined, about 6 cents. Virtually all the energy consumed by ranges is billed at 3 cents, since all monthly use in excess of 60 kw.-hr. is at that rate.

Accurate information on the percentage of residents supplied within the territory served by the company's distribution lines is not available, but it is believed that saturation is about 90 per cent.

It has been the policy of the company since 1918, according to M. W. Arthur, manager sales and distribution, to engage actively in the sale of merchandise through a subsidiary corporation, which has for the last year or so returned a fair profit.

A small display room is used. Major appliances are sold on either the crew-manager or resale plan. Approximately 85 per cent of the total sales volume is composed of outside sales and only 15 per cent are store sales. Merchandising has always been upon a basis permitting effective and profitable competition by other dealers.

The volume of the company merchandising business was $267,000,000, in 1926, or somewhat more than $5.25 for each residence electrical customer. All local department stores and several hardware dealers have active electrical departments. A number of successful appliance dealers are established in Akron and the smaller cities served by this company. Table and floor lamps, the radio and the refrigerating machine have added a considerable load in the last two or three years.

Water-heater business may be actively pushed in the future in an endeavor to raise further the average sales per residential customer. Before doing so tests will be made to obtain approximations of average bills. These tests will include a determination of the average use of hot water by families and kilowatt-hours required for each gallon used.

Committee Recommends Changes in Water-Heater Practice

New York Association Offers New Measure of Desirable Sizes for Tanks and Heating Elements—Tests Prove Satisfactory Results and Economy to Users

ACCEPTED standards of type, tank size and size of element for electric water heaters are considered unsuitable for conditions in New York State, according to the first report of the electric water-heater committee* of the Empire State Gas and Electric Association. An analysis of existing installations and available types indicated the present use of large (3- to 5-kw.) elements with a relatively small storage tank. Among the disadvantages connected with this practice are high wiring installation cost ($20 to $50), larger transformer, meter and line capacity requirements, expense and complexity of double-throw switch installations, greater danger of steam generation, production of day-time peak loads, need of three-wire systems, and a short period of operation which precludes off-peak use. With smaller heaters, 110-volt, two-wire No. 14 conductor service can be used.

Analysis of Requirements

Water heaters constitute an off-peak problem, according to the decision of the committee, and to justify the low rate needed (1 to 2½ cents) the question must be approached on that basis. It has been found possible to design and market economically a type of storage heater that will operate in off-peak hours and that is the only type which it is thought can be sold in New York State in large volume. No other domestic appliance approaches the water heater as a wholesale consumer of current, adding 400 kw.-hr. per month without high bills, provided the rate structure is right.

The small-element, large-tank system is recommended. The size of the storage tank should approximate the twelve-hour use in gallons by the consumer. Tests have demonstrated the high thermal efficiency of these installations where they fit, approximately, the hot water demand. The average family uses from 40 to 60 gal. per day. Such consumption requires a tank of that size with a 1-kw. heating unit. The 30- to 40-gal. consumption of a small household is considered to need a 660-watt unit. Receptacles having 72- to 100-gal. capacity should have 1,500- and 2,000-watt units respectively. In large homes, instead of a 100-gal. tank, one of 75-gal. capacity may be used with an additional 600-watt, 5- or 10-gal. element and storage tank to meet peak demands.

Regulation convenience outlets permit loads up to 1,300 watts, so that such installations for the average home can be connected without additional wiring expense. Piping,

*H. C. Wilder (chairman), Northeastern Power Corporation, Rome, N. Y.

labor and material costs are estimated at $7 to $8 per installation. Equipment can thus be sold to consumers at manufacturer's list price and leave a small merchandising profit.

Overload Test Data

One test indicated that where the daily use of hot water was 100 gal., two 30-gal. tanks in tandem, connected with a 1-kw. element, placed an abnormal load on the installation. In spite of this, the heater furnished reasonably warm water at practically all times of day for two baths and four sinks, used by six persons. The tank capacity under such conditions should have been, in theory, 100 gal. instead of 60 gal. for perfect service. It is practical to install larger capacities than 60 gal. in large houses, but the element in such cases should be 2 kw. This represents the extreme high demand that it is probable will be encountered. This experiment demonstrated that extreme conditions can be met with the small-element, large-tank principle, because it represented a 20-kw.-hr. use per day, of which 8 or 9 kw.-hr. were off-peak. The cost of this hot water service at a theoretical 2-cent rate would be about $12 per month, which compares favorably with other competitive forms of water heating. It is equal to a similar gas water system with a $1.70 rate. All tests were based on a 100 deg. rise. This electric installation had no automatic devices or time clocks, except a thermostat, and could be manufactured and installed completely for $200 or less.

A rate not to exceed 2 cents per kilowatt-hour is desirable, according to the report, and can be justified more readily with the small-heater-unit, large-tank plan with its off-peak load than with the large-heater small-tank installations. More than half of the current would be used during the night or off-peak period, according to the results of experiments with this type. The entire success of this principle of water heating depends absolutely upon the rate. There is said to be no other serious problem involved that cannot be overcome.

Automatic devices, other than the thermostat, are not recommended by the committee. Temperature settings of 100 to 170 deg. F. as a maximum are suggested. The sensitiveness of the thermostat should receive particular attention in each installation in order to throw the maximum current on the off-peak periods. The differential of the thermostat may be from 30 to 50 deg., but depends entirely on a study of the individual installation.

The claim that intermittent heaters are cheaper to operate should be considered in connection with radiation losses chargeable against storage systems. Heat losses with the type advocated should not exceed the equivalent of 2½ kw.-hr. a day and should average, at 2 cents per kilowatt-hour, $1.20 per month for the 30-gal. size of tank. This extra cost is more than offset by the advantages of partial off-peak operation and the availability of an automatic supply of water day and night.

Committee Recommendations

Domestic water heating should be an off-peak load.

Storage tank should be equivalent in size to daily consumption of hot water by the household.

Heating elements should insure long period of daily use at low current consumption.

Cost of equipment, installed, should not exceed $200.

Rate should not exceed 2 cents per kilowatt-hour.

The price installed should approximate $160 and should not exceed $200 if undue sales resistance is to be avoided. Wholesale users may be made of residential customers by offering this type of heater and an appropriate rate.

The committee summarized its findings as follows:

1. The ideal type of electric water heating for the average family is a 40 to 60-gal. well-insulated storage tank with a 1-kw. or 1,500-watt element, equipped only with thermostat. For smaller requirement, a 30-gal. tank with a 660-watt heater is feasible.

2. The heating element must be as small as possible to provide that one-half of the current consumption will occur at night or in off-peak hours.

3. Based on average use of 400 kw.-hr. monthly, one-half of which is off-peak, the rate must be 1½ or 2 cents per kilowatt-hour to be attractive to the customer.

4. These rates should be attractive to the companies because of the large amount of off-peak current consumed, the desirable power-factor characteristics, the absence of peaks during day or night and utilization of the existing transformer and line capacity.

5. When quantity production is realized, the maximum cost installed should be well under $200 for the 60-gal., 1-kw. size.

6. Rather than competing with existing gas water heating, this type of water heating will create new revenue out of coal and oil bills.

7. Hundreds of rural communities and larger villages as well as 96,000 farm customers in New York State can be sold hot water service with this type of system and thereby aid in making rural extension profitable.

8. Piping and wiring costs for this type are very low.

9. It is vitally important to study each individual installation before recommending tank and element size best suited.

10. No domestic load compares with water heating, which uses three times the electric range consumption and eight times the refrigeration consumption, although each load is desirable and economically sound from the customer's standpoint.

Use of Connected Lighting Load

FIELD experience of the illuminating engineering division of the commercial and industrial department of Charles H. Tenney & Company, Boston, Mass., has led to the compilation of the accompanying tabulation of yearly use of connected lighting loads in various classes of installations which the division has encountered in its practice. These data have worked out well in estimates of annual energy consumption prepared by the division under W. S. Wallace, illuminating engineer, who states that whereas other values may

ANNUAL HOURS USE OF CONNECTED LOAD FOR VARIOUS TYPES OF COMMERCIAL CUSTOMERS

Kind of Establishment	Annual Hours Use of Connected Load
Armories and dance halls	1,500
Bank	500-1,000
Barber shop	3,000
Bowling alleys and billiard parlors	3,000
Churches	500
Clubs	2,200
Factories	1,000
Filling stations	2,000
Flood lighting	2,000-4,000
Garage	1,500
Hospital	2,000
Hotel	2,500
Library	2,000
Lunch rooms	2,000-4,000
Offices and public buildings	1,800
Restaurants	1,000-2,000
Schools (day)	300- 500
Schools (boarding)	500-1,000
Showcases	2,000
Signs	2,000
Signs (billboards)	2,000
Stores (under 2 kw.)	1,200
Stores (over 2 kw.)	1,800
Stores (drug and candy)	2,000
Theatre (regular and vaudeville)	1,700
Theatre (movie)	700
Windows	1,800
Yard lighting	2,000-4,000

be regarded as satisfactory in other companies, those given in the table represent the best results of experience in utilities under Tenney management to date. V. M. F. Tallman is manager of the department.

Electrified Dairy Saves Over $900 Yearly

BY E. C. EASTER
Agricultural Engineer Alabama Power Company, Birmingham, Ala.

IN THE summer of 1926 a three-ton ammonia ice plant was installed in the Alabama Dairy Company located twelve miles west of Birmingham on the Warrior highway and operated by M. W. Brice. This dairy has 70 cows and produces about 135 gal. of milk per day, the milk being retailed in bottles, with two deliveries per day. The ice plant is used to cool the milk and to make ice to crack over the bottled milk to maintain a low temperature en route to market. The installation cost of the ice plant, including a well-insulated cold storage room about 6x8x7 ft. was $2,300.

The milk is cooled immediately after milking to 34 deg. F. by pouring it over a surface cooler through which a cold brine solution is pumped. After cooling, the milk is bottled and placed in the cold storage room, where a temperature of 36 deg. F. is maintained. For delivery, the crated bottles are placed in a truck with about 2 lb. of cracked ice per gallon of milk scattered over the bottles. This is done only during the hot weather. This enables Mr. Brice to deliver milk at a temperature not over 40 deg. F.

The connected load for this equipment is a 3-hp. motor for operating the ice plant and a ½-hp. motor for the brine pump. The average monthly energy consumption from June, 1926, to May, 1927, has been 504 kw.-hr., an average of 7.2 kw.-hr. per cow per month, or an average of 0.12 kw.-hr. per gallon of milk cooled. These figures include the brine pumping and ice making.

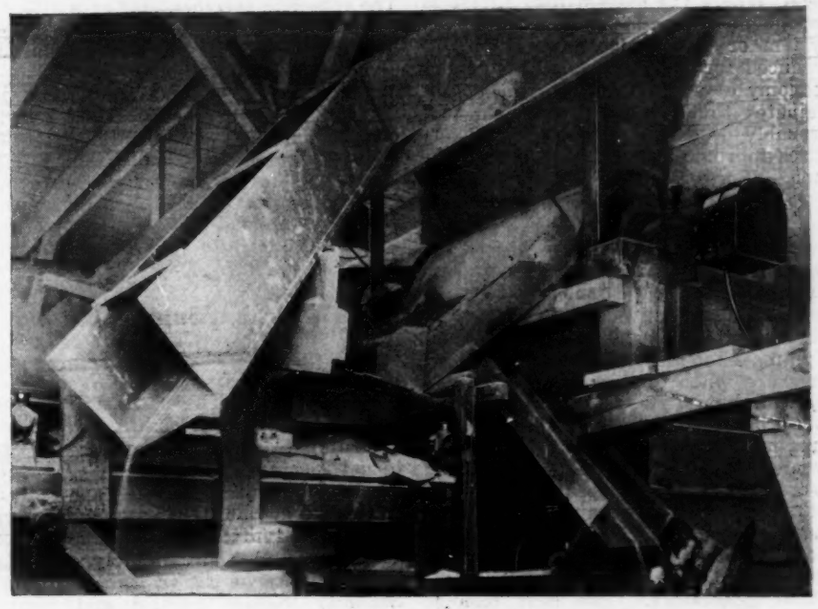
The cost of electricity for operating the refrigeration system, including a monthly demand charge of $1.50 per kilowatt of connected load, has been $18.29 per month. If interest, depreciation and taxes on equipment at 16 per cent annually is included, the total cost per month is $48.96. Prior to installing this equipment, Mr. Brice was using an average of 600 lb. of ice per day, which at 40 cents per hundred cost him $2.40 per day, or $72 per month. Thus, the refrigerating and brine system is resulting in a net saving of $276 per year. Then, too, Mr. Brice has made an installation to take care of a 150-cow dairy, expecting to increase his production. At the same rate of energy consumption and ice for the increased dairy the net saving will be $70 per month, or $840 per year.

Mr. Brice is also using an electric motor to operate his milking machine, which he states saves him the expense of one man's labor in operating the dairy. He is paying his labor $17.50 per week, or $75.83 per month, based on a 52-week year. The milking machine cost $975 and the energy consumption averages 165 kw.-hr. per month, or 2.3 kw.-hr. per cow. At the rates given above the average cost per month is $8.78, which with interest, depreciation and taxes on the equipment amounts to a total of $21.78. This results in a net saving of $54.05 per month, or $648.60 per year.

The net saving to this dairy resulting from the use of electric service amounts to $924.60 per year, not considering the fact that both the refrigerating system and the milking machine will take care of a 150-cow dairy. Mr. Brice states that there is also a decided advantage from the use of electric lights and there is a convenience in the use of this equipment that is very valuable to the dairyman.

Automatic Magnetic Pulley Aids Glass Production

APPARATUS for separating from glass sand all magnetic material, such as hematite, magnetite, ilmenite, minute particles of iron abraded from the surface of crushers, screens or other iron machinery, and even particles of iron attached to sand crystals or entirely included in them, has been installed in the plant of the United States Silica Company of Ottawa, Ill. The process is used because extremely low iron content is necessary to avoid coloring the glass. Large quantities of sand are submitted to a very strong magnetic field by passing it over the bare face of a magnetic pulley instead of over a belt, as is the usual practice.



IMPURITIES ARE REMOVED FROM GLASS SAND BY MAGNETIC PULLEY UNIT

To remove magnetic particles collected on the face of the pulley the control mechanism demagnetizes the pulley for a few seconds approximately once every minute. At the same time a stiff brush extending the full width of the pulley is brought to bear against the pulley face on the back side. This brush removes all magnetic particles which have been seized, allowing them to fall into a chute.

Immediately the face of the pulley has been brushed clean the magnetizing current is again applied by the automatic control mechanism. The entire cycle is repeated approximately once a minute. Approximately 75 tons of sand per hour are handled by the separator.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Steam Generation.—THOMAS ROLES.—The increasing use of superpressure steam, with its effect upon the economy of generation and influence upon capital structure, is considered in the light of operating data obtained for stations in Britain, the United States and Germany. Turbine efficiencies and boiler-plant efficiencies in these countries are compared. The author concludes that future stations constructed to handle base loads of large systems will use high-pressure steam throughout, of the order of 500 lb. to 700 lb. per square inch. Where the station load factor is dependent upon the load factor of the system or where high pressure is introduced for the purpose of increasing economy of an existing station, he anticipates that the plant installed will probably be designed to work at pressures approximating 1,000 lb. per square inch.—*World Power*, July, 1927.

Cottland Plant, Sweden, Designed for High Pressure.—A high-pressure unit of 5,600-kw. capacity, designed for operation at a maximum steam pressure of 800 lb. per sq.in., has recently been installed in Sweden. Present operation is at 400 lb. pressure, but the design makes it possible to adopt a higher pressure when load conditions require it, with but slight modification of the low-pressure turbine blading. A high-pressure 1,400-kw. turbine designed to receive steam at 600 lb. gage exhausts to a 4,200-kw. low-pressure turbine at 142 lb. gage. The exhaust steam, however, is first reheated to 752 deg. F. Both turbines, of the double rotation type, are direct coupled to two three-phase generators. The heat balance diagram is given in this article. It is estimated that when generating 72,000 kw.-hr. at an average load of 3,000 kw. the coal consumption will be 1.08 lb. per kw.-hr.—*Power*, July 19, 1927.

PRELIMINARY PLANT PERFORMANCE

Boilers in service	1	2
Steam pressures, pounds per square inch	.....	398
Temperature after high-pressure superheater, deg. F	752	689
Temperature after low-pressure superheater, deg. F	770	779
Total generated kw.-hr.	14,100	30,720
Auxiliary power, kw.-hr.	1,470	1,285
Net output, kw.-hr.	12,630	29,435
Coal consumption net B.t.u. per kw.-hr. (referred to 13,500 B.t.u. coal)	1.91	1.41
Load factor, per cent	17.5	42.7

Generation, Control, Switching and Protection

Tests on High- and Low-Voltage Oil Circuit Breakers.—PHILIP SPORN and HARRY P. ST. CLAIR.—Data from a large number of tests on several types of oil circuit breakers are given in this paper. The tests were made on breakers with the following ratings: (a) 150-kva., 1,500,000-kva.; (b) 35-kv., 250,000-kva.; (3) 7,000 volts, 75,000-kva.; (d) 132-kv., 1,250,000-kva., and (e) 132-kv., 750,000-kva. These tests were made on power systems having sufficient connected capacity to make the tests conclusive. Complete data are tabulated and oscillograms are shown.—*Journal American Institute of Electrical Engineers*, July, 1927.

A 10-Kw. 20,000-Cycle Alternator.—M. C. SPENCER.—This paper discusses briefly the advantages and limitations of the inductor and reaction types of alternators when designed for generating alternating currents of very high frequency. A new design for a reaction type alternator is described, in which some of the limitations of the usual type of reaction alternator have been overcome in a way which enables such alternators to be designed for a higher frequency and a greater output. The complete specifications of a 10-kw., 20,000-cycle alternator of the new type are given and its operating characteristics, as determined by test, shown by a series of curves. A method is developed by means of which the various losses in the alternator may be separated and the complete operating characteristics of the alternator under any conditions of load predetermined from the no-load tests.—*Journal the American Institute of Electrical Engineers*, July, 1927.

Transmission, Substations and Distribution

Stability of Large Power Systems.—F. H. CLOUGH.—The natural limit for power stability of a circuit is reached, according to the author, when the external reactance is about 100 per cent, or, in other words, in the case of a transmission line, the maximum power will be transmitted when the impedance of the load is approximately equal to the reactance of the transmission line. Stability voltage control and power limits of electric power systems and machines particularly large alternating-current systems are considered in this article. The author concludes that synchronous machines can be made sufficiently stable for all the usual purposes of power supply and that the power limits and voltage regulation of the transmission circuit depend principally on series reactance. The power limit of a line will depend primarily upon the total reactance, which should not exceed about 50 per cent. More stable conditions will exist if synchronous condensers are installed. Voltage control at the supply point by means of synchronous condensers is more conveniently and satisfactorily carried out than by raising the voltage at the sending end, which would be necessary if no synchronous condensers were installed. Synchronous condensers can provide reactive kva. where it is wanted, near the load, and consequently lagging current need not be transmitted over inductive lines, and the voltage regulation of the system is improved.—*Journal of Institution of Electrical Engineers (England)*, July, 1927.

Inspection and Testing of Cable.—The report of the underground systems committee of the National Electric Light Association indicates that no marked departures from past practices have been made in the acceptance inspection and testing of cable at the factory or in the testing of cable after installation. The inspection and testing of new cable is, however, becoming more and more comprehensive and exacting. The results of inspection of nearly 2,000,000 ft. of paper-insulated lead-covered cable in 1926 indicates a continual decrease in the percentage of cable that fails to meet the specifications. The report includes a summary of the causes for the rejection of this material and of the factory high-voltage tests and procedures as well as breakdown tests and analysis of test results. It is stated that the full benefit of systematic inspecting and testing of cable can only be obtained if the record of the cable in service is systematically followed. A comparison of the record of sections which fail in service with the inspection and test records of these sections, will give information of value in determining the effectiveness of the specifications and the acceptance tests.—*National Electric Light Association* (1927).

Maintenance of Distribution Transformers and Their Devices.—An investigation was undertaken by the overhead systems committee of the National Electric Light Association to determine the practice of member companies concerning maintenance methods and procedures as applied to overhead lines and apparatus. The report recommends periodic inspection of transformers, fuse or cut-out boxes, disconnecting devices and lightning-arrester equipment. It is suggested that in sections where the ground conditions are poor individual experiments should be made to enable companies to determine accurately the nature of the grounds. A number of procedures for determining this resistance are given.—*Report to National Electric Light Association*, 1927

Units, Measurements and Instruments

Hardness Testing of Steel Balls by Magnetic Method.—F. R. WILLIAMS.—The author states that of all the methods now used for testing the hardness of steel balls the magnetic method seems to offer the greatest promise as no injury is offered to the ball in the process of testing. In the usual tests wearing qualities and resistance to crushing blows are impaired. It is stated that eventually it should be possible to find definite relations between the magnetic and other physical properties of bodies due to the apparently fundamental principle that there is but one set of physical and chemical properties corresponding to a given set of magnetic characteristics. The method

of testing steel balls proceeds on the assumption that the external fields of permanent horseshoe magnets or electromagnets are distorted when a steel ball is placed between their poles. The greatest distortion will occur when the permeability is largest, which in general is true of the softer material. If a magnetometer is placed in this field, then the position of the needle in the magnetometer will be different when the ball is present from the position when it is removed. A soft ball should give a larger deflection of the magnetometer than a hard one.—*Transactions of American Society for Steel Treating*, 1926.

The Vibrometer.—H. NUKIYAMA AND M. MATSUDAIRA.—The vibrometer as discussed by the authors is a device which provides a means of measuring the mechanical vibration in phase and magnitude by determining motional, mutual impedence with an alternating-current potentiometer. The discussion proceeds almost entirely along mathematical and theoretical lines, but the results of an experiment with this instrument are given in which the velocity of vibration was determined. The authors believe that the vibrometer, though it is not yet well developed, will cover a wide field of application in the study of mechanical vibration including acoustical problems.—*Selected Papers of Journal of Institute of Electrical Engineers of Japan, No. 13.*

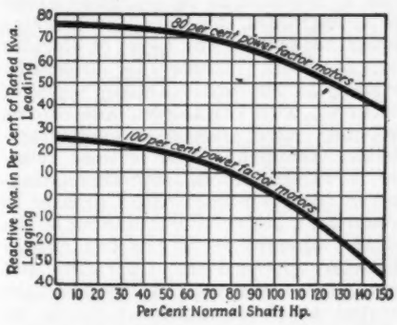
Heat Applications and Material Handling

Heat Transfer Through Insulation in the Moderate and High-Temperature Fields.—L. B. MCMILLAN.—An analysis of the existing knowledge of heat transfer through insulating materials, showing in what respect this knowledge is insufficient and pointing out the directions in which future research work is most urgently needed, has been undertaken in a systematic way. The method of determining mean temperatures and the economic data are apparently new. An endeavor has been made to present the subject from a fresh point of view. The particular subject of this research is the literature referring to heat transfer through insulation in the temperature range between the refrigeration and the refractories fields, with the specific exception of literature pertaining to heat transfer through building materials. It is indicated that the phase of heat transfer in which further research is urgently needed is study of surface effects.—*Mechanical Engineering*, August, 1927.

Design of Dished and Flanged Pressure Vessel Heads.—A. B. KINZEL.—In this paper the author undertakes to present what are believed to be rational methods of design, allowing for the stresses in all parts of the head concave to the pressure. From a development of the formulas applicable to calculation of stresses in the head of the pressure vessel the discussion advances to a consideration of the bending moment in a non-spherical head, the design of a boiler with manhole and the bending moment to be found in manhole flanges. In conclusion, the author states that experiments and calculations both in Europe and in this country show that (1) the present method of designing pressure-vessel heads is subject to improvement; (2) the design described in this paper, namely, an ellipsoidal head with a ratio of axes of two to one, is quite satisfactory; (3) the manhole flange symmetrically placed and calculated as a hollow cylinder has many advantages.—*Mechanical Engineering*, June, 1927.

Motors and Control

Application of Synchronous Motors in Steel Mills.—HARRY A. WINNE.—The opportunity for the use of the synchronous motor in steel-mill service is estimated by the author. In this field the synchronous motor is considered to be the competitor of the squirrel-cage induction motor, and the two types are compared. The starting torque of the synchronous motor is usually better than that of the corresponding squirrel-cage induction motor and at least 100 per cent pull-in torque can be obtained. The most desirable feature of the synchronous motor is its ability to furnish leading reactive kva. for power-factor correction. Synchronous motors for main roll service are usually designed for 80 per cent leading power factor at full load. The fact that low-speed induction motors operate at undesirably low power factors has necessitated the use of reduction gears in many cases where for other reasons a direct drive would have been preferable. A synchronous motor, however, has a good power factor regardless of its speed and may make possible direct drive where an induction motor would require gearing. The efficiency and power factor of the synchronous motor warrant its careful consideration for constant speed, general-purpose drives of possibly 50 hp. and greater capacity. The minimum capacity of drive for which such motors should be considered will vary with the installation, depending upon the size of the power system, existing system power factor and cost of power.—*Industrial Engineer*, July, 1927.


80 per cent power factor motors
100 per cent power factor motors
Reactive Kva. in Per Cent of Rated Kva.
Leading
Lagging
80 70 60 50 40 30 20 10 0 10 20 30 40
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Per Cent Normal Shaft Hp.

LEADING REACTIVE KILOVOLT-AMPERES AVAILABLE WITH VARIOUS LOADINGS OF SYNCHRONOUS MOTORS

Electrophysics, Electrochemistry and Batteries

High Vacuum and Its Technical Applications.—L. G. CARPENTER.—The general principles of the kinetic theory of gases are stated as an introduction to a consideration of the methods, both mechanical and chemical, which may be used to obtain high vacua. The evolution of gas from the walls of the vessel being evacuated is discussed in relation to the time element. Technical applications in the manufacture of lamps and vacuum tubes for wireless apparatus, X-ray tubes and thermal galvanometers, with a consideration of the particular problem involved in the fabrication of each type, are considered.—*World Power*, July, 1927.

A Search for the Villari Reversal Effect in Nickel.—S. R. WILLIAMS.—The Villari effect, or variation of magnetic induction and flux in a specimen of iron which has been magnetized with and without a tension of considerable magnitude upon it, has been investigated previously. The author has endeavored to duplicate with nickel samples the experiments which have been made upon iron specimens. The point of intersection of the two magnetization curves obtained with and without tension and known as the Villari reversal point was the object of his determination. This effect has been identified as the reciprocal of the Joule magnetostrictive effect. Similar samples were tested under eleven different sets of physical conditions, and the author concludes that in the tension magnetization curve of nickel there are no Villari reversal points, and consequently those reported by previous investigators are assumed to be fictitious.—*Journal of Franklin Institute*, June, 1927.

Miscellaneous

Heating Time Constants.—D. HILARY WILLS.—The author considers the variable nature of the heating-time constant for forced cooled machinery from a theoretical point of view and gives the results of tests of an alternator and a transformer confirming the theory experimentally. The importance of the variation is illustrated by a study of the permissible short-time overloads for an air-blast-cooled transformer, the results being checked by actual tests which indicate the possibility of errors of the order of 60 per cent if the variation in time constant is not taken into account. The author concludes that this discrepancy is due to the fact that the exponential heating-time law is not strictly applicable to an actual machine. The time constant is not independent of the loading, owing to the non-homogeneous nature of the machine and the non-uniform distribution of the watt loss. The final steady temperature rise is not strictly proportional to the total watt loss, and for very heavy overloads the initial rate of temperature rise is greater than is represented by the exponential relation.—*World Power*, July, 1927.

Estimation of Velocities in Water Conduits.—Based upon the assumption that the velocity of flow varies as some fractional power of the hydraulic radius of the pipe and as another fractional power of the slope, two charts have been evolved to permit the estimation of the velocity of water in pipes or in open channels. Allowance is provided for differences in the roughness of the walls and for variations in the hydraulic radius. An illustrative example is included.—*Engineering (England)*, July 22, 1927.

New Books

Hydraulics

By E. W. Schoder and F. W. Dawson. New York: McGraw-Hill Company, Inc. 371 pages, illustrated.

This is a splendid text covering the basic principles of hydraulics. It is written from the viewpoint of an engineer, yet is fundamental in its treatment and rigid in its analysis of hydraulics. The physical phenomena of hydraulics are explained, and the authors then develop the formulas for the application of basic hydraulic laws. The book then covers the subject by the use of practical examples and experimental data as applied to many hydraulic problems. New data are included in large number, and the graphs and charts are of high grade, many being new. While written as a text, this book can well be used by all engineers who deal with fundamental hydraulics in a quantitative manner. Orifices, weirs, pipes, laws of variation, logarithmic plotting and many other topics are discussed thoroughly.

Methoden der Angewandten Geophysik

By Dr. Richard Ambronn. Dresden and Leipzig: Theodor Steinkopff. 258 pages, 84 illustrations.

This is essentially a source book of methods for the application of physics to the solution of geological problems. Of the 205 pages of text, almost precisely half are devoted to magnetic, radioactive and purely electrical methods, including the use of alternating high-frequency currents. Research methods, their theory and practical application, are tersely discussed. Aside from serving as a résumé of a science that has undergone remarkable expansion within comparatively recent years, the book should be of particular value to the scientist or to the engineer whose work brings him into contact with geological problems, because of the apparently very thorough combing of the literature in the particular field which it embodies. Almost every page contains from half a dozen to thirty references. The bibliography covers 33 pages in utmost condensation. The list of abbreviations shows about 300 titles, most of them periodicals, and thus covers innumerable individual references.

G. F. W.

Thermodynamics

By J. E. Emswiler. New York: McGraw-Hill Book Company, Inc. 296 pages, illustrated.

This second edition represents a thorough revision of the original treatise on the subject and reflects the progress that has been made in the application of the principles of thermodynamics during the last six years. Of the new material which has been added, mention must be made particularly of the articles on the representation of heat quantities on the temperature-entropy diagram and their interpretation, on a reduction of initial condensation and re-evaporation lost by compounding, on vapor refrigeration, on the internal-combustion engine, and on the air-steam mixture. A chapter has been added dealing with the various means employed in modern steam power plants for extending the range and efficiency of the Rankine cycle, and several articles have been devoted to a consideration of the principles of the multiple-effect evaporator.

Electric Elevators

By F. A. Annett. New York: McGraw-Hill Book Company, Inc. 437 pages, illustrated.

The author has succeeded admirably in his presentation of the problems arising in the design, construction, operation and maintenance of elevators and their motors and controls. The book is intended to be useful to architects, engineers, students and building superintendents. The types of elevator designs which include the automatic-leveling or automatic-landing types of machines, with variable-voltage control systems, have received particularly skillful treatment. The sections relating to direct-current and alternating-current drives should assist greatly in producing a better understanding of the relative advantages of the two classes of motor applications. Operating and maintenance men will find the chapters devoted to the location of faults in mechanical equipment and in direct and alternating-current motors and controls to be of special value.

Mr. Annett has produced a highly usable book, one authoritatively stating present knowledge of this phase of modern transportation. As the author of "Electrical Machinery" and an editor of *Power*, he is well prepared to consider various viewpoints.

Electric Switch and Controlling Gear

By Charles C. Garrard. Third edition, revised and enlarged. New York: D. Van Nostrand Company. 783 pages, illustrated.

A thorough and complete book which classifies switches and relays and gives the principles of design and operation has been written by Mr. Garrard. While the work is British in viewpoint and approach, the author has incorporated worldwide material and practices. There is nothing very new in the book, but good work has been done in assembling material on this aspect of electrical activities. In the appendices British standardization rules are given and summaries of other standards. Relay-control principles are well discussed. The complete line of switches, from knife switches to oil breakers of various types, are discussed from both a design and an operating point of view. The material on high-capacity oil breakers of American make is, however, out of date because of the recent developments in American designs, especially as regards speed of operation.

Switchboards of all types are illustrated and discussed in detail. The handling of short circuits and grounds is treated in a very comprehensive manner. The detail and the completeness of the book are such that any one interested in this aspect of the art will find present practices well outlined and can get from a study of it many ideas as to what to do and what not to do as an aid in further development.

Dielectric Theory and Insulation

By J. B. Whitehead. New York: McGraw-Hill Book Company, Inc. 154 pages, illustrated.

This is a series of lectures on dielectric theory and insulation given by Dr. Whitehead as an exchange professor in France. He has attempted to coordinate the diverse material and to reconcile the conflicting data and experiments. The field of composite dielectrics has baffled scientists and experimenters for years, and a valuable piece of work has been done by the author in expressing the status of the problem in logical terms. The lectures are well-rounded presentations starting with elementary theory and experiments. The author then discusses Maxwell's absorption theory, the destructive breakdown theory, the pyroelectric theory of Wagner and other theories and experiments dealing with composite dielectrics. Much original material is included on insulation and on dielectric behavior under alternating stress. The book should be very useful to students of dielectric phenomena.

Book Notes

The Magneto Manual. By H. R. Langman. London: Crosby-Lockwood & Sons. 221 pages, illustrated.

This book is one of Lockwood's manuals addressed to the mechanic and shop worker. According to the preface, the subject matter of the book is taken from lectures given by the author to practical engineers and apprentices. The text of the book is confined more to exposition of design and operating characteristics of various types of magnetos than to the description of makes of machines on the market. From its perusal the reader should be able to gather a very comprehensive idea of the factors entering into the design of magnetos to be applied to different uses.

Modern Ignition Simply Explained. By Charles H. U. Cross. London: Crosby-Lockwood & Sons. 144 pages, illustrated.

Here is an elementary manual of automobile ignition directed specifically to the repair man in the garage. After simple explanations of current flow, the relation between magnetism and electricity, types of generators and storage apparatus, the book goes on to describe various standard ignition systems. To the average automobile mechanic the book should be of value. Even though its descriptions and references are largely of and to European apparatus, yet the principles of operation are the same as in American equipment.

Books Received

Dielectric Phenomena. By S. Whitehead, B. A. New York: D. Van Nostrand Company, Inc. 175 pages, illustrated.

Applied Magnetism. By T. F. Wall. New York: D. Van Nostrand Company, Inc. 262 pages, illustrated. Price, $8.

Commerce Yearbook 1926—United States. By Julius Klein. Washington, D. C.: United States Government Printing Office. 676 pages, illustrated. Price, $1.

History of Incandescent Lamp. By John W. Howell and Henry Schroeder. Schenectady, N. Y.: Maqua Company. 208 pages, illustrated.

News of the Industry

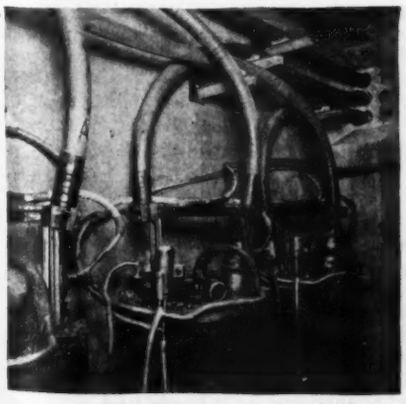
New York's 132-Kv. Cable in Service

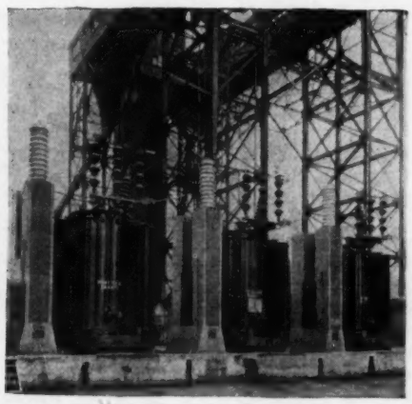
Twelve Miles of Single-Conductor, Hollow-Core, Oil-Filled Cable from Hell Gate Generating Station to Dunwoodie Substation Is Energized

FORMAL testing and placing in service of the 132,000-volt underground cable which has been installed to connect the Hell Gate generating station of the United Electric Light & Power Company with the Dunwoodie substation of the New York Edison Company, 12 miles distant, took place on Tuesday, Aug. 9. Officials of the New York Edison-United System and invited guests, including representatives of the Pirelli and General Electric companies, were present. Since the cable had on the preceding Friday been subjected to acceptance tests of 300,000 volts for fifteen minutes, the formal testing at that voltage on Tuesday was not continued for so long a period. Those attending had the opportunity of seeing at close range the indoor 132-kv. remote-controlled disconnecting switches, the 132-kv. cable terminals, the 13,800/132,000-volt outdoor step-up transformers, the kenotron testing apparatus, equipment for making the cable joints, elevated reservoirs for maintaining a head of oil inside the cables, a schematic drawing of the features of the installation, and photographs of the joints in preparation, the oil reservoirs, and joints which sectionalize the oil in the cables about every mile. The formalities were ended when Nicholas F. Brady, president of the New York Edison and United companies, closed the switches which energized the cable.

This cable run has a carrying capacity of 90,000 kw. and will serve to tie the New York companies together with the Yonkers Electric Light & Power Company and Westchester Lighting Company. As explained in previous articles*, the cable is of the single-conductor, hollow-core, oil-filled type, oil pressure in which is maintained to avoid gas voids in the insulation by elevated reservoirs at the terminals and at intermediate points. About every mile throughout the run are stop joints looking like transformer cases, into which corresponding cables in adjacent sections run through terminals. In these joints the cables are electrically connected, but barriers are interposed to sectionalize the oil passages. Half of the cable was manufactured by the Pirelli Cable Company of Milan, Italy, and the rest by the General Electric Company under arrangement with the Pirelli company.

*See ELECTRICAL WORLD, July 2, 1927, page 28, and the 1927 report of the A.I.E.E. committee on transmission and distribution.





132-KV. OIL-BARRIER CABLE JOINTS (PLACED ABOUT EVERY MILE), AND 132-KV. TRANSFORMERS AND CABLE TERMINALS AT HELL GATE

Ohio Attorney-General Calls Commissions Failures

In addressing the Columbus (Ohio) Rotary Club on Aug. 9 Attorney-General Edward C. Turner of Ohio charged that both public utility commissions and legislative bodies have failed ignominiously in their efforts to protect the public. In substantiation of his remarks Mr. Turner contended that while the present rate-making basis of the commissions is intrinsically wrong, the state legislatures are taking no steps designed to remedy what he termed a deplorable condition.

"There never was a time in the history of the country when participation in politics by the business man was so badly needed as now," the Attorney-General said. "Something over twenty-five years ago we started out in this country to regulate public utilities through commissions. Today this costly machinery is ineffective and unable to handle the problem of rate making for which it was created. I make the unqualified statement that the public utility commissions throughout the country have been, in general, failures and that Ohio has been no exception. Created to protect the public, the public utility commissions have failed ignominiously. Instead of protecting the public, the effect of the work of these commissions has been to put a premium on poor management and reckless financiering. The responsibility for this situation does not rest primarily upon the membership of these commissions; the primary responsibility is with the legislature. When experience had demonstrated some years ago that the original basis or theory upon which these commissions were created was a failure, it was the duty of the legislature to correct the matter.

"Unless the hard-headed business men of this state get into the game of politics," Mr. Turner concluded, "these matters will get worse, not better. While the problem of rate making is one of government, it is primarily a business problem. It is economic rather than political. The government is needed as an umpire to see that there is fair play on both sides. The business man is needed to point out how to get fair play for both sides."

I. E. C. Program Arranged

Hydraulic Turbines, Rating of Electric Machinery, Voltages and Insulating Oils Among Topics

A FULL preliminary program has been issued for the meeting of the International Electrotechnical Commission in Italy next month, which includes the itinerary—Bellagio, Como, Milan, Venice, Florence and Rome—and, condensed, is as follows:

Sunday, Sept. 4.—Leave Como for Bellagio by special boat. Official welcome. Reception in evening.

Monday, Sept. 5.—Conference opens. Topics: Prime movers, rating of switches, measuring instruments. Meeting of advisory committee. Garden party.

Tuesday, Sept. 6.—Topics: Prime movers (hydraulic turbines), rating of electrical machinery, voltages, insulating oils. Banquet.

Wednesday, Sept. 7.—Topics: Same as on Tuesday. Automobile trip to and luncheon at the Alpe del Borgo.

Thursday, Sept. 8.—Topics: Prime movers (steam turbines), nomenclature, terminal markings, screw-lamp caps and holders, symbols, radio lamps.

Friday, Sept. 9.—Trip by boat to Varenna, thence by train to Chiavenna. Visit to the Liro electrical plant.

Saturday, Sept. 10.—Topics: Prime movers (steam turbines), nomenclature, terminal markings, radio lamps, symbols, traction motors.

Sunday, Sept. 11.—By special boat to Como, where the Volta centenary will be commemorated in conjunction with the International Congress of Physics. Official luncheon. Return in evening to Bellagio.

Monday, Sept. 12.—Topics: Traction motors, rules and regulations, rating of rivers, symbols. Committee of action. Council meeting. Venetian soiree on lake.

Tuesday, Sept. 13.—Departure for ten-day tour to Milan, Venice, Florence and Rome.

Thursday, Sept. 22.—Plenary meeting in Rome and close of conference. Visits to Pisa, Genoa, Turin and Modane follow on Friday and Saturday.

The delegation to the meeting from

the United States will be made up as follows:

T. Beran, General Electric Company.
W. M. Bradshaw, Westinghouse Electric & Manufacturing Company.
J. H. Dellinger, Bureau of Standards.
S. E. Doane, National Lamp Works.
W. F. Durand, Stanford University.
L. L. Elden, Boston Edison company.
F. Hodgkinson, Westinghouse Electric & Manufacturing Company.
D. C. Jackson, Boston.
R. D. Johnson, New York.
H. M. Hobart, General Electric Company.
W. G. Kelley, Chicago.
A. E. Kennelly, Harvard University.
P. M. Lincoln, Cornell University.
C. O. Mailloux, New York.
L. B. Marks, New York.
J. F. Meyer, Bureau of Standards.
F. W. Peek, General Electric Company.
S. G. Rhodes, New York Edison Company, New York.
C. H. Sharp, Electrical Testing Laboratories, New York.
C. E. Skinner, Westinghouse Electric & Manufacturing Company.
E. D. Tanzer, Day & Zimmermann, Philadelphia.

Clayton H. Sharp is the president and H. S. Osborne the secretary-treasurer of the United States National Committee of the I.E.C.

Wigginton E. Creed Dies

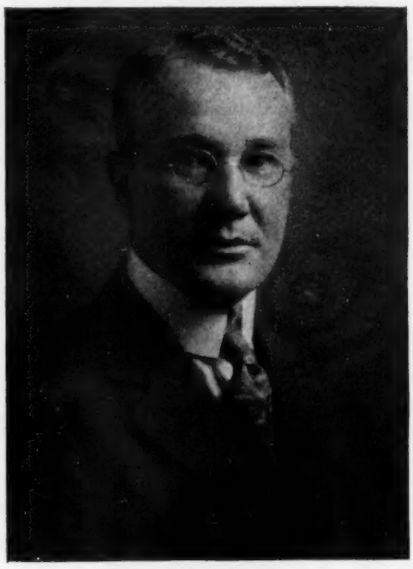
President of Pacific Gas & Electric Had Displayed Signal Ability in Public Utility Field—Had Headed San Francisco Company Since 1920—Prior Career

WIGGINTON ELLIS CREED, president of the Pacific Gas & Electric Company of San Francisco, died at his home in Piedmont, Cal., on Saturday, Aug. 6. He had for some time been a sufferer from a disorder caused by stomach trouble. Mr. Creed, who was only fifty years of age, was by profession a lawyer who early became interested in the problems of public utility service and who since his election to the presidency of the San Francisco company in 1920 had taken a leading place among light and power executives on the Pacific Coast and in national counsels.

Born in Fresno, Cal., on Feb. 8, 1877, Mr. Creed was educated in the public schools of Oakland and the University of California. After graduation in 1897 he taught school for some time in order to continue the study of law. His practice began in San Francisco in 1900 and was maintained until five years ago. His career in the public utility field began in 1915, when as attorney for the People's Water Company of Oakland he successfully reorganized that company, then in deep water. In recognition of his demonstrated ability in rehabilitating this utility he was made president of the company and of its successor, the East Bay Water Company, serving in that capacity until 1920.

In the latter year the resignation of the late Frank G. Drum as president of the Pacific Gas & Electric Company resulted in Mr. Creed's appointment to that office. In the seven years of his incumbency the company grew with great rapidity, its far-sighted program of vast hydro-electric development on the Pit River was vigorously pushed, and it absorbed by lease or purchase all the important electric properties in northern California except the Great Western and the California-Oregon. The latest transaction of this kind was the purchase of the three Byllesby properties reported in these columns on May 7 (page 978).

Mr. Creed's interest in the light and power industry was not, however, confined to his native state. He very soon became known in electrical circles throughout the country and took a prominent place in the deliberations of the National Electric Light Association. As chairman of the water-power development committee of the association,



WIGGINTON E. CREED

Mr. Creed reported to the 1926 Atlantic City and the 1925 San Francisco convention. At the Pacific Coast meeting he emphasized the opposition to government ownership and faith in private development that were an outstanding article in his industrial faith, declaring: "All that has been accomplished has been done through private courage and initiative. Nothing like it could have been attained through the restricting influences of government ownership—federal, state or municipal. Thinking people know this and today see less need for government management or ownership than ever before."

Not only was Mr. Creed a leader in the public utility field in the West, but his varied interests led him into many industrial fields. As president of the Columbia Steel Company he played a prominent part in the organization of a Pacific Coast steel industry, building a large blast furnace and coking plant in Utah for supplying pig iron to steel mills in California. At the time of his death the major portion of his attention was being given to the steel industry. He was president also of the C. A. Hooper Foundation and the Contra Costa County Bank of Pittsburg, Cal., and was a director of the Wells-Fargo Union Trust Company, the Associated Oil Company and the East Bay Water Company. His interest in education resulted in his appointment as a regent of the University of California in 1918. He also served as trustee of Mills College, Oakland. He was a keen student of economics and was an authority on taxation, serving as a member of the California Taxpayers' Association and the Economy League.

To a keen, analytical mind and a grasp of financial problems Mr. Creed united an aggressive though friendly and democratic personality and forcefulness as a public speaker—qualities which naturally brought him into the foreground. The esteem and affection which he inspired are indicated in the three tributes from prominent central-station executives on the Pacific Coast which follow.

From FRANKLIN T. GRIFFITH, *president Portland Electric Power Company:*

"The character and magnitude of the tasks courageously undertaken and successfully accomplished by Wigginton E. Creed in his all too brief career furnish definite assurance that the even larger problems of the near future within his field of operations, under his wise direction and with the force of his dynamic personality, would have been solved in a manner to reflect additional credit upon him and his great organization and also to redound to the benefit not only of the people of California but of the entire Pacific Coast. He was a commanding figure in the industry of the nation—loyal, fearless, sane. His good works will live, and the lessons of his life will long be an inspiration to those of us who still carry on."

From R. H. BALLARD, *vice-president Southern California Edison Company:*

"Wigginton E. Creed was one of the foremost citizens in a state where the standards of citizenship are high. He was born in California and always lived in and for California. His birthright was the hardihood of the pioneer—a spirit that served him well in the many enterprises in which he was personally interested and in countless other activities in which his counsel was sought. His sturdy physique and brilliant mind were evident in his ability to do a great number of things and do them all well. His vision was keen, his decision fair and his judgment sound. He was rich in the homely virtues of friendliness, and he was respected and loved by thousands who will long remember him for his unselfishness, his readiness to assist in every worthy cause, his thorough kindliness and his honesty in every thought and deed."

From A. G. WISHON, *president San Joaquin Light & Power Corporation:*

"In the passing of Wigginton E. Creed the electrical industry has lost one of its great leaders. A studious, far-seeing and vigorous man, his high ideals of public service were grounded in sound business sense and untiring energy that made him a splendid citizen. I admired him as a co-worker and cherished him as a friend and, realizing that his place can never be filled, I feel that his work and purposes will have a lasting influence for good."

Sound Keynote for Co-ordination

Association of Electragists International, in Convention at St. Louis, Hears Encouraging Messages from the Three Other Major Divisions of the Industry

NEW impulse was given to the promotion of industry co-ordination and purpose this week at the convention of the Association of Electragists International held at the Hotel Chase, St. Louis. Executive officers of the four major electrical associations sounded the keynote in a call for a united industry to undertake in an efficient, organized way the intensive market development without which obstacles will lie across the path of further electrical progress. With a registration of 800, this active nucleus of the contractor-dealers of the country gathered for four days of well-attended meetings that were notable for the earnestness with which the practical problems on the program were presented and discussed.

Clyde L. Chamblin of San Francisco, president of the association, placed the issue frankly before the industry in his opening address by picturing the present inadequacy of house wiring and the difficulty of improving the practices of the very large number of small contractors throughout the country who are neither prospering themselves nor helping the industry to prosper because of conditions surrounding them to which all branches of the industry are carelessly contributing. "The A.E.I. will yield to none," he said, "in its desire and effort to be in the forefront of progressive, open-minded, united study of mutual industry problems. But the A.E.I., with a membership of 2,300, is attempting to set up policies and ideals for the contractor-dealer branch of the industry, although we represent less than 10 per cent of the total number in the country. With the electrical industry standing in the forefront in wealth and power among the industries of the country, should 2,300 men alone be expected to give of their time and money to do this job unaided, when individually they have the least to gain? What will it avail if the policies within our industry remain unsettled and each branch is selfishly fighting for itself alone? If only a fraction of the money being spent to create good will with the public could be directed to the work of training the shock troops of the industry, what a dividend it would return!" Mr. Chamblin appealed for a united industry effort to organize for this great coming task.

President H. T. Sands of the National Electric Light Association was at the last moment prevented from being present, but his paper was read by Louis H. Egan, president of the Union Electric Light & Power Company of St. Louis. It elicited sustained applause by frankly meeting the challenge voiced in May before the convention of the N.E.L.A. by Joseph A. Fowler, former president of the A.E.I., in a series of questions submitted to the power industry on the subject of the trade relations between the utilities and the contractors in matters of merchandising.

Sketching the early days when the central station was compelled to take the entire responsibility for introducing electricity into use, Mr. Sands discussed the difficulty of making all companies understand that today other branches of the industry are also deeply concerned in the local market for electrical equipment and entitled to consideration. To the question "Does the average utility executive care whether or not the contractor-dealer respects and trusts the service company?" he replied: "No utility executive is fit for his position who is not concerned that every element in the community should respect and trust his company, more especially those whose co-operation is necessary in the upbuilding of his business." Again, to the query "Has the central station a moral or legal right to sell merchandise or do inside wiring at less than cost and charge the loss to energy selling expense?" he answered: "Not being a lawyer, I will not attempt to answer as to the legal right. As regards the moral right, I believe such a course to be unethical and unsound, unbusinesslike and entirely unnecessary." Mr. Sands closed with a plea for a clean slate on old grievances and a new spirit of tolerance and co-operation in carrying forward the common problems of market development.

D. Hayes Murphy, vice-president of the National Electric Manufacturers' Association, pointed to the need of a new basis of contact between the four branches of the industry in which frankness will supplant the old reserve and suspicion and to the interdependence of all groups in the face of the present overproduction of manufactured goods and the keen price competition throughout the industry that can only be overcome by more effective market development. He urged that the manufacturing industry give immediate thought to assisting the electragists to build up their membership, in order that a larger proportion of contractors may come under the influence of the association, and he pledged the co-operation of his company.

George E. Cullinan, national chairman of the Electrical Supply Jobbers' Association, discussed the position of the jobbers in the present market situation and called for a united front by the entire industry. The proficiency and prosperity of the electrical contractor and dealer are fundamental to the progress of electricity, he said, and the contractors must be educated to the necessity of making a reasonable profit on every job, just as the public must be educated to the value of good and adequate electric wiring. He also urged that the jobbers' salesmen be enlisted in the cause of upbuilding the membership of the A.E.I. to broaden its influence.

H. H. Courtright, president of the Valley Electrical Supply Company of California, presented his "through-the-dealer" merchandising plan that has been so successfully operated throughout the territory served by the San Joaquin Light & Power Corporation.

Earl Whitehorne, commercial editor of the ELECTRICAL WORLD, reported to the association as chairman of the recent industry conference on wiring and presented a chart picture of the present trend in house wiring, emphasizing the urgent need of intensive marketing by the entire industry.

K. A. McIntyre reported on the present status of the Society for Electrical Development.

The contractor-dealers' medal and purse for 1927, given under the James H. McGraw award, were presented to Joseph A. Fowler, as reported on page 339 of this issue.

Klamath River Projects

Conflicting Applications for Licenses Filed with Federal Commission—Saluda License Executed

THE Electro Metals Company of San Francisco has applied to the Federal Power Commission for a license, in accordance with the terms of its preliminary permit, covering its project on the Klamath River near Orleans, Cal. As the company cannot obtain the state rights for this development, it has filed the application for a license simply with the idea of safeguarding its interest and complying as far as possible with the requirements of the water-power act. In similar fashion A. P. Seybold of San Francisco has filed his application for a license for his project on the Klamath River in the same vicinity.

Frank F. Faucett of Polson, Mont., has applied for a preliminary permit covering a project on Pauline Creek near Bend, Ore. The application makes no reference to the power capacity of the stream.

The California-Oregon Power Company of San Francisco has applied for a license covering a transmission line 77 miles long to connect with the Pacific Gas & Electric Company's lines. The line will extend from Prospect No. 2 power plant to the Copco No. 2 plant. The California-Oregon company also has applied for a license covering a transmission line from Chiloquin, Ore., to Brown, Ore.

The license covering the twenty-million-dollar Saluda River project of the Lexington Water Power Company of Columbia, S. C., was executed on Aug. 8. As the final plans for the dam, power house and spillway have not been completed in all their details, the license gives a period of six months for the submission of these plans. The dam, which will be at Drehers Shoals, will be 183 ft. high, creating a reservoir which will contain 1,725,000 acre-feet of usable storage. The initial installation will develop 173,000 hp. Ultimately it is expected to install 260,000 hp.

A license has been issued to the city of Colorado Springs, Col., covering the 4,300-hp. power structures which are used in connection with the city water supply. When the structures were built it was not recognized that federal rights were required. The city requested a license so as to bring the plants strictly within the requirements of the water-power act.

N.E.L.A. Committee Heads

Appointments for Year 1927-28, to Serve Under the New Administration, Are Almost Complete

CHAIRMEN have now been appointed for nearly all the national committees of the National Electric Light Association. As given out by the new administration, the list is as follows:

SPECIAL COMMITTEES

Advertising—Frank Leroy Blanchard, Henry L. Doherty & Company, New York, N. Y.

Charles A. Coffin Prize—H. T. Sands, Electric Bond & Share Company, New York.

Codes and Standards — Irwin W. Day, Connecticut Light & Power Company, Thompsonville, Conn.

Constitution and By-laws — W. C. L. Eglin, Philadelphia Electric Company, Philadelphia.

Electrification of Steam Railroads—Britton I. Budd, Public Service Company of Northern Illinois, Chicago.

Exhibition—E. W. Goldschmidt, Wagner Electric Corporation, New York.

Finance — Sidney Z. Mitchell, Electric Bond & Share Company, New York.

Lamp—Frank W. Smith, United Electric Light & Power Company, New York.

Prize Awards—W. H. Onken, Jr., ELECTRICAL WORLD, New York.

Public Policy—R. H. Bullard, Southern California Edison Company, Los Angeles.

Rate Research — Edwin Gruhl, North American Company, New York.

Water-Power Development — Paul A. Schoellkopf, Niagara Falls Power Company, Niagara Falls.

GENERAL COMMITTEES

Educational—Fred R. Jenkins, Commonwealth Edison Company, Chicago.

Membership—Howard K. Mohr, Philadelphia Electric Company, Philadelphia.

Rural Electric Service—Charles F. Stuart, Northern States Power Company, Minneapolis.

ACCOUNTING COMMITTEES

Executive—E. A. Davis, Middle West Utilities Company, Chicago.

Classification of Accounts—H. C. Hasbrouck, Portsmouth Power Company, New York.

Customers' Records — B. F. McGuire, Commonwealth Edison Company, Chicago.

Fixed Capital—M. R. Scharff, Duquesne Light Company, Pittsburgh.

General Records—F. J. Brett, Buffalo, Niagara & Eastern Power Corporation, Buffalo.

Purchasing and Storeroom—R. G. Smith, North American Company, New York.

Statistics—J. E. Loiseau, Public Service Company of Colorado, Denver.

COMMERCIAL COMMITTEES

Executive — J. E. Davidson, Nebraska Power Company, Omaha.

Commercial Cooking—A. M. Lloyd, Commonwealth Edison Company, Chicago.

Competitive Power—H. W. Derry, Union Gas & Electric Company, Cincinnati.

Electrical Advertising—C. J. Eaton, Middle West Utilities Company, Chicago.

General Merchandising — C. E. Greenwood, Edison Electric Illuminating Company, Boston.

Industrial Heating—W. H. Sammis, Consumers Power Company, Jackson.

Home Lighting—C. L. Dunn, Ohio Public Service Company, Cleveland.

Lighting Service — J. Daniels, Edison Electric Illuminating Company, Boston.

Promotional Rates — T. F. Kennedy, Henry L. Doherty & Company, New York.

Street and Highway Lighting—R. J. Malcomson, Public Service Company of Northern Illinois, Chicago.

Transportation—L. M. Branch, Commonwealth Edison Company, Chicago.

Water Heating—H. K. Griffin, Western States Gas & Electric Company, Stockton, Cal.

Wiring—A. P. Good, Commonwealth Edison Company, Chicago.

ENGINEERING COMMITTEES

Executive—E. C. Stone, Duquesne Light Company, Pittsburgh.

Accident Prevention—K. R. MacKinnon, Nebraska Power Company, Omaha.

Electrical Apparatus—J. M. Oliver, Alabama Power Company, Birmingham.

Engineering Administration—H. P. Liversidge, Philadelphia Electric Company, Philadelphia.

Hydraulic Power—Byron E. White, Utica Gas & Electric Company, Utica, N. Y.

Inductive Co-ordination—J. C. Martin, Middle West Utilities Company, Chicago.

Meter — E. E. Hill, New York Edison Company, New York.

Overhead Systems—Harold Cole, Detroit Edison Company, Detroit.

Prime Movers—E. B. Ricketts, New York Edison Company, New York.

Underground Systems—J. W. Sylvester, Philadelphia Electric Company, Philadelphia.

PUBLIC RELATIONS COMMITTEES

Executive—J. F. Owens, Oklahoma Gas & Electric Company, Oklahoma City.

Co-operation with Educational Institutions—Carl D. Jackson, 36 West Forty-fourth Street, New York.

Customer Ownership — P. G. Gossler, Columbia Gas & Electric Company, New York.

Industrial Relations — Homer E. Niesz, Commonwealth Edison Company, Chicago.

Manufacturers' Advertising—T. J. McManis, General Electric Company, Schenectady.

Public Speaking—W. S. Vivian, Middle West Utilities Company, Chicago.

Women's—Miss Sophia Malicki, Middle West Utilities Company, Chicago.

Purchases and Mergers

Former Foshay West Coast Properties Are in New Hands—Large Subsidiary Is Formed for Continental

ACCORDING to supplemental articles filed with the State Corporation Department of Oregon, properties formerly controlled by the People's West Coast Hydro-Electric Corporation, a W. B. Foshay organization, consisting of electric plants and transmission lines serving forty towns and cities in California, Oregon and Washington, now have headquarters at 27 William Street, New York, the address of the Federal Water Service Corporation, a holding concern which has recently purchased many of the important water services on the West Coast. The People's West Coast Hydro-Electric Corporation was last March reported sold, with most of the other Foshay interests, to G. L. Ohrstrom & Company, New York. Officers of the hydro utility company are now named as follows: President, E. C. Teal; treasurer, D. L. McDaniel; secretary, F. W. Peters. Oregon headquarters are in the Bedell Building, Portland.

The Southern Public Utilities Company took over the South Carolina Gas & Electric Company at Spartanburg, S. C., on Aug. 4, according to announcement from the Charlotte headquarters. The taking over of the Spartanburg company completes the transfer of the public utilities companies in the two Carolinas purchased some time ago by the Duke interests.

The Iowa & Nebraska Light & Power Company has purchased the stocks and bonds of the Nebraska Gas & Electric Company, the Lincoln Public Service Company, the Iowa Service Company and the Maryville (Mo.) Electric Light & Power Company, the control of which has rested in the Continental Gas & Electric Corporation. The new company will form a third large subsidiary of the Continental, the other two being the Kansas City Power & Light Company and the Columbus (Ohio) Railway, Power & Light Company. All of the companies in the Iowa-Nebraska group have been dissolved and the assets passed to the new organization. Lincoln will be the operating headquarters for the entire group, which serves about 300 communities.

To segregate assets, the Alliance (Ohio) Power Company has been incorporated under state laws by W. E. Davis, E. W. Sweezy and O. K. Ayers, officials of the Stark Electric Company at Alliance. The company can issue 1,200 shares of stock, no par value. The new company will take over the electric power business of the Stark Electric. It holds franchises to supply power and light in Stark, Columbiana, Mahoning, Portage and other counties in northwest Ohio.

The Illinois Power & Light Corporation has purchased electric light and distribution systems in Williamsville, Sherman, Broadwell and Elkhart, Ill., and taken over management of the power distribution there. The corporation had previously sold power to the local systems.

The town of Early, Iowa, voted on Aug. 3 to sell its electric distribution system to the Iowa Public Service Company. Eight years ago the town sold its generating station, but retained its distribution system, buying its energy from a transmission line. By selling Early gets enough to pay off all of its indebtedness against the plant and virtually all of its municipal bond indebtedness. It gets also a 20 per cent reduction in rates.

Applications by the Montana-Dakota Power Company for permission to buy the electric property at Hanks, N. D., from the Hanks Hardware Company and the electric property at Grenora, N. D., from Foss & Astrup have been approved by the North Dakota Board of Railroad Commissioners.

Official Nominees Named for Directors of S. E. D.

The secretary of the Society for Electrical Development reports the following official nominees for directors as having been named by the several nominating committees under the by-laws of the society:

To represent central-station group: H. T. Sands, president N.E.L.A., one year; J. E. Davidson, chairman National Commercial Section, N.E.L.A., one year; Paul S. Clapp, managing director N.E.L.A., one year; W. W. Freeman, three years; Charles L. Edgar, two years; John F. Gilchrist (additional), one year.

To represent manufacturer group: Gerard Swope, president N.E.M.A., one year; A. E. Waller, managing director N.E.M.A., one year; S. L. Nicholson, representing N.E.M.A., three years; W. E. Sprackling, two years; Fred R. Farmer, one year; H. B. Crouse (additional), one year.

To represent jobber group: G. E. Cullinan, chairman executive committee E.S.J.A., one year; managing director E.S.J.A. (when appointed), one year; Frank S. Price, representing E.S.J.A., one year; O. Fred Rost, three years; B. E. Finucane, two years; W. I. Bickford (additional), one year.

To represent contractor-dealer group: C. L. Chamblin, president A.E.I., one year; Laurence W. Davis, general manager A.E.I., one year; W. Creighton Peet, representing A.E.I., one year; James R. Strong, three years; Joseph A. Fowler, two years; C. M. Beltzhoover (additional), one year.

To represent "at-large" group: J. Robert Crouse, three years; James H. McGraw, two years; C. A. Ward, one year.

To represent local electrical leagues: J. E. North, chairman League Council, one year; H. A. Brooks, one year; R. Bourke Corcoran, one year; David C. Birdsall, two years.

The election will be held in the society's offices, New York, on Sept. 9.

Activity in Lone Star State Unabated

Expansion Continues in Eastern and Central Sections of Texas—Recent Reports from Half a Dozen Light and Power Companies

ELECTRICAL activity in Texas has been the subject of many items in these columns in recent months. Its continuous character is shown by the following announcements made in the last week or two:

Material for a high-voltage transmission line is being received and right-of-way cleared by the Texas Power & Light Company. This line will run from the company's generating station at Trinidad through the heart of east Texas, 100 miles. The line will be of wooden-pole construction and will pass through the oil fields near Jacksonville, through the iron-ore fields at Cushing and on to Nacogdoches and Lufkin, taking electric power into one of the most productive sections of east Texas. "This new electric power line will be completed in the early fall," John W. Carpenter, vice-president of the company, declared, "and will aid in the industrial growth of east Texas, a trend which is already noticeable. The line will be of sufficient capacity to supply the cities which it will serve with electricity and also provide ample power for industrial needs. East Texas is destined to become as well known for its industrial achievements as for its agricultural records."

Construction of a 70-mile high-tension line by the allied Texas Electric Service Company to run from the new generating station at Odessa to the oil field in Winkler County will be started immediately, according to Mr. Carpenter. The new line will be of wooden-pole construction and will run via the towns of Monahans and Wink.

Important extensions of the transmission system of the Texas Power & Light Company of Dallas are to be made also in the Austin territory, according to W. B. Head, chairman of the board of directors of the company. The company has just purchased the plants at Jarrell, Schwertner, Florence, Leander and Liberty Hill and will connect these places to its high-tension lines. From Taylor a 60,000-volt line will be constructed to a point near Round Rock, thence south to a point just north of Austin, where a substation will be constructed. Another substation will be installed at Round Rock. From the Round Rock substation a power line will be constructed to Cedar Park, Leander and Liberty Hill. Later this line will be extended to Burnet, where it will connect with the company's existing line. From the substation near Austin a line will be constructed to Dessau, Sprinkle, New Sweden, Daffan, Manor, Govalle, Delvalle and Hornsby, and later the main line will be extended south to San Marcos, 35 miles, where it will connect with that part of the company's power transmission system which runs from Taylor via Elgin, Bastrop and Lockhart to New Braunfels. Wooden-pole construction will be used. The company recently completed a line out of Bartlett west to Florence.

Since the beginning of this year 240 miles of 66,000-volt transmission lines have been completed or their erection begun by the Central Power & Light Company, serving the western part of the state. In addition to this, approximately 70 miles of 11,000-volt and 13,000-volt lines have been built, according to the company's current letter to stockholders.

Eighty-three miles are being constructed to connect the generating plants of Corpus Christi and Victoria. Forty-four additional miles will connect Schulenberg and Luling, resulting in the complete interconnection of the steam plants at Victoria and Corpus Christi with the company's hydro plants along the Guadalupe River and permitting operation of these plants at higher load factor with accompanying lower production costs.

In the Winter Garden district, southwest of San Antonio, 40 miles of 66,000-volt line will interconnect that district with the power supply of San Antonio. In the Rio Grande Valley a 66,000-volt line is being built along the military highway on the Rio Grande River, connecting San Benito with Mission, 40 miles away. This is the second line between these towns, and it will permit the addition of a large irrigation pumping load. West from Mission to Rio Grande City a 33-mile, 66,000-volt line is being constructed.

The West Texas Utilities Company has completed the installation of a 5,000-kw. turbo-generator at San Angelo, the first to be housed in the new generating station. The new turbine, of Allis-Chalmers manufacture, will be the smallest of four to be installed in the San Angelo station. When the other units are installed the plant will be one of the largest in the Southwest. Besides the Allis-Chalmers unit the plant will have an additional capacity of 1,000 kw. from the steam Corliss and McIntosh-Diesel units already in operation. Urgent demand for power and light in the new oil fields and other industries in west Texas brought about the completion of the plant two months ahead of the date set for completion.

The Dallas Power & Light Company has completed the installation of a 25,000-kw. turbine, which increased the capacity of its plant to 57,500 kw. This capacity will provide for present requirements and for the growth of Dallas in the near future, according to C. W. Davis, vice-president and general manager of the company.

The Texas Power Corporation has selected a site on the Guadalupe River for its main hydro-electric plant, which is to be one of three similar plants that the company is to construct on that river between Seguin and New Braunfels. The main plant will be at McQueeney, near Dam No. 3. It will have an operating head of approximately 44 ft. under normal operating conditions. In it there will be two 2,600-hp. waterwheels to drive two 2,250-kva. generators, two governors, remote-control equipment and switchboard. The spillways will incorporate bear-trap gates in accordance with the designs of Huber & Lutz of Switzerland. This will be the first installation of such collapsible gates in this country, it is said, although numbers of such installations have been made abroad which have proved successful.

The Syndicate Power Company has purchased land as the site of the electric power plant which it is to construct on the Colorado River near Kingsland. The dam to be built across the river will be 180 ft. high and the power plant will have a capacity of 40,000 hp.

Briefer News

Hearings on Potomac River Hydro-Electric Project. — Public hearings in connection with the proposed development of the Potomac River will be held at Harpers Ferry, W. Va., on Aug. 24 by the United States Engineer of the Washington district. A further hearing will be held in Washington the following day.

Detroit Edison's Service Building Extension.—The service building of the Detroit Edison Company on Second Avenue has been much enlarged by the addition of an extension on the Elizabeth Street end of the plot. Like the old portion of the building, the extension is ten stories high, and it will contain 28,000 sq.ft. of floor space, making a total of 200,000 sq.ft. A general rearrangement of departments and offices will follow.

Contemplated Development on the Spokane River. — Overlow rights and right-of-way privileges are being purchased and filing made with the federal land office at Spokane covering a power site on the Spokane River, in east central Washington, near where that river flows into the Columbia. The rights are being acquired by the Big Bend Transit Company, which is associated with the Pacific Power & Light Company of Portland, Ore.

New England Power Engineers Elect Officers.—At the annual meeting of the New England Association of Central-Station Power Engineers, held last week at the Kernwood Inn, Beverly, Mass., J. W. Wattles of the Edison Electric Illuminating Company of Boston was elected chairman, A. W. Milliken of the New Bedford Gas & Edison Light Company vice-chairman, and Thomas D. Bond of Charles H. Tenney & Company, Boston, secretary and treasurer. A new board of directors was elected consisting of J. W. Wattles, L. R. Wallis, A. S. Moore, E. D. Learned and V. M. F. Tallman.

New Orleans' New Unit Nearly Ready.—The New Orleans Public Service, Inc., plans to spend $55,000,000 over a period of ten years. This amount is necessary to provide for the increasing demand for power, gas and transportation facilities. The program calls for an expenditure of $4,000,000 per year, with an additional $1,500,000 for replacements. The 30,000-kw. turbo-

generator being added to the Market Street power plant of the company is scheduled to go into service early in September. It will bring the total capacity of the station to 108,000 kw.

Norwich, Conn., Starts Its New Municipal Plant. — To the 7,000-kva. steam generating plant of the city of Norwich, Conn., there was added on Aug. 1 a new hydro-electric station just finished by the city at a cost of $175,000 and containing two generators rated at about 500 hp. each. The city has hitherto purchased energy from the Uncas Power Company.

Springfield (Mass.) Company to Enlarge Office Building. — The United Electric Light Company of Springfield, Mass., has had plans drawn for an addition of three stories and basement, 60 ft. x 54 ft., to its office building at 73 State Street. Work on the addition, estimated to cost $125,000, will be started soon after Aug. 1. Construction will be of steel frame with brick walls and limestone trimmings and will match the present building. The interior will be used entirely for offices. The enlargement will leave space for still further expansion.

Eastern Iowa Power Company to Build Another Hydro Plant.—The Eastern Iowa Power Company of Cedar Rapids expects to erect a hydro-electric plant early in 1928 on the Maquoketa River, near Canton, on site of an old mill. The plant will develop about 3,000,000 kw.-hr. annually and will be erected at a cost of $350,000, according to J. D. Wardle, chief engineer of the company. A 19-ft. dam will be built. Preliminary plans have been prepared. This plant will rank as the second largest hydro-electric installation in Iowa, the largest being the company's Lakehurst plant near Maquoketa.

Illinois Power & Light Agrees Not to Carry Lines Through Protesting City.—Because of the protest of Champaign (Ill.) officials and citizens against the Illinois Power & Light Company's plan of carrying high-tension transmission lines across public and private property in the city, this protest being made to the Illinois Commerce Commission, a compromise has been arranged whereby the line will circle the city to the north and then continue westward. Location of a steel tower near public school property caused the complaint in the first instance and led to general opposition to running the line through the city.

Interstate Connection Between Missouri and Kansas. — Announcement is made by J. E. Harsh, general manager of the Empire District Electric Company, with headquarters at Joplin, Mo., and with service lines in Missouri, Kansas and Oklahoma, that exchange of power between the generating systems of that company and the Kansas Gas & Electric Company, with headquarters in Wichita, through interconnection of transmission lines, will be possible as soon as construction work now in progress is completed. It is believed that the interconnection will be in operation by the spring of 1928. The Empire District company has a generating plant at Riverton, Kan., which will be tied in with the new transmission system.

"Breaking Even" on a Thunderstorm. —On Aug. 1 a violent thunderstorm interfered with operation at Rochester, N. Y., causing short circuits on high-tension cables and bringing about one of the most serious interruptions to service experienced in many years. The damage cost the Rochester Gas & Electric Corporation $10,000 to repair, but, according to Thomas H. Yawger, superintendent of the electric division of the company, the rise in the waters of the Genesee River caused by the storm counterbalanced the loss. "Counting the rise period, the period of peak flow and the period of lowering of the waters, the power furnished by the water will just about wipe out the debt caused by the storm," Mr. Yawger said in summing up the outcome.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see the ELECTRICAL WORLD for July 2, page 50.]

International Association of Municipal Electricians—Salt Lake City, Aug. 16-19. E. H. Benz, West New York, N. J.

Camp Co-operation VII—Association Island, Henderson Harbor, N. Y., Aug. 28-31. Society for Electrical Development, 420 Lexington Ave., New York.

National Electrical Manufacturers' Association—Policies Division, Association Island, N. Y., Sept. 1-3; Apparatus Division, Briarcliff, N. Y., Oct. 24-27. S. N. Clarkson, 420 Lexington Ave., New York.

Wisconsin Utilities Association, Electric Section—Madison, Wis., Sept. 2 and 3. J. N. Cadby, 432 Broadway, Milwaukee.

Eastern Division, N.E.L.A.—Bedford Springs, Pa., Sept. 7-10. H. A. Buch, 212 Locust St., Harrisburg, Pa.

New England Division, N.E.L.A.—New London, Conn., Sept. 12-15. Miss O. A. Bursiel, 20 Providence St., Boston.

American Institute of Electrical Engineers—Pacific Coast convention, Del Monte, Cal., Sept. 13-16. F. L. Hutchinson, 36 West 39th St., New York.

Great Lakes Division, N.E.L.A. — French Lick Springs, Ind., Sept. 22-24. R. V. Prather, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

Association of Edison Illuminating Companies—Colorado Springs, Col., Sept. 26-30. P. S. Millar, 80th St. and East End Ave., New York.

Empire State Gas and Electric Association—Electric Meter Section, Hotel Syracuse, Syracuse, Sept. 15-16; annual convention, Lake Placid Club, Lake Placid, N. Y., Oct. 6 and 7. C. H. B. Chapin, Grand Central Terminal, New York.

International Association of Electrical Inspectors, Western Section—Toronto, Canada, Sept. 27-29. W. S. Boyd, 175 W. Jackson Blvd., Chicago.

American Electric Railway Association—Cleveland, Oct. 3-7. J. W. Welsh, 292 Madison Ave., New York.

Illuminating Engineering Society — Edgewater Beach Hotel, Chicago, Oct. 11-14. L. H. Graves, 29 West 39th St., New York City.

Eastern Association of Electrical Inspectors — Springfield, Mass., Oct. 12-13. E. P. Slack, 85 John St., New York.

Rocky Mountain Division, N.E.L.A.— Broadmoor Hotel, Colorado Springs, Col., Oct. 17-20. O. A. Weller, 900 15th St., Denver.

National Association of Railroad and Utilities Commissioners — Dallas, Tex., Oct. 18-21. James B. Walker, 270 Madison Ave., New York.

Public Utilities Association of West Virginia—Parkersburg, W. Va., Oct. 26-27. A. Bliss McCrum, 514 Charleston National Bank Bldg., Charleston, W. Va.

New Hydro Plant on the Shenandoah. —A 2,000-hp. electric plant on the Shenandoah River, 3 miles west of Luray, Va., built by the Page Power Company, is ready for service. The concrete dam, which is of the Amberson type, is 400 ft. long and 14 ft. high and is built on the site of a dam of the Shenandoah River Light & Power Company which gave way several years ago. In the power house there are three generating units. This new plant, which is virtually a duplicate of the company's installation on the south branch of the Shenandoah River, at Newport, Va., is capable of expansion should demand make it necessary.

Canadian Minister Puts Steam Production Above Water Power for Prairie Province.—The development of electrical energy from coal, rather than from water power, is advocated for the Western Province of Alberta by Charles Stewart, Canadian Minister of the Interior. Discussing the Alberta Spray Lakes power site, Mr. Stewart said that Albertans would be much farther ahead to develop electric power from coal, since there are great quantities in the province. Electric power, he said, could be manufactured just as cheaply from coal as from water power and would provide more employment. In addition, this plan would not spoil any of the natural beauties of the approach to the Banff National Park.

Idaho Power Company Rates to Come Up Again in Oregon.—Hearings to determine new rates for the Idaho Power Company in Oregon will be opened by the Oregon Public Service Commission at Ontario on Aug. 19. This will virtually be the reopening of an investigation which had its origin as far back as 1919. Conditions at that time led to a tariff now held to be wrongly based and uneconomic. The matter comes before the commission on application of the Idaho Power Company to set aside an order suspending certain new tariffs submitted for filing by the utility. The Oregon action was instituted jointly with one before the Idaho Public Utilities Commission, a ruling of the latter having been set aside by a federal court decision, as recorded under "Court Decisions."

Hydro Project on Kootenay in British Columbia Affects Idaho.—A license to permit damming the Kootenay River, in lower British Columbia, for the development of 35,000 hp., a hydro-electric project of the West Kootenay Light & Power Company at Granite, near Nelson, B. C., was sought recently at a hearing before the provincial water rights branch held at Trail. As backwater would affect districts of Idaho, there is a question of international settlement to be worked out before a license can be granted. Deforestation in the district has cut down the flow of the Kootenay River about one-half, it was shown, and the company proposes

to equalize the run-off, cutting it down in the fall and hurrying it in the spring. Water in Kootenay Lake, as a reservoir, would be held to a level about 6 ft. above the present low water.

Nebraska's Sole "Farmers' Light District" Still in Difficulties. — The law passed last winter by the Nebraska Legislature validating a bond issue of $35,000 made by the Farmers' Electric Light District No. 1, the only district set up under a law since declared unconstitutional, is being challenged in court. The district was created ten years ago, a distribution system erected and a long-time contract for energy made with the Wahoo municipal plant. Under the recent legislation an attempt to go on with the plan was made by the Saunders County Commissioners, but strong opposition has arisen on the part of land owners who object to being included among the financial supporters of the project.

St. Lawrence Board of Engineers Suggests Third Plan for Power Development.—A third scheme of development for the international section of the St. Lawrence River has been tentatively put forward by the joint board of engineers studying the project. It concerns an alternative two-stage project, the upper dam for which would be at Chrysler Island, east of Morrisburg, Ontario. The Chrysler Island project would cost about $4,000,000 more than the Ogden Island two-stage project, but is said to promise greater financial returns. The Chrysler Island power plants could be put into operation two years before those under the other plan could be completed, it is said, and, operating under a 34-ft. head until such time as the lower level is raised, about 780,000 hp. would be available, or about 300,000 hp. more than the Ogden Island project in the upper stage.

Recent Court Decisions

Payment in City Bonds of Contractors Who Built Plant Not a Sale.—Iowa Service Company vs. City of Villisca concerned a case where the electors of the city had voted to incur an indebtedness in the sum of $75,000 for the establishment of a light and power plant for the municipality and to issue bonds therefor. The bonds were advertised for sale, but no bids were obtained thereon. Thereafter the city entered into a contract with contractors to construct the light and power plant and provided that the bonds in question should be delivered to the contractors at par in payment of the contract price. In holding that the proposed exchange of bonds was not a sale within the state statute, the Iowa Supreme Court said: "The contract under consideration, which purported to dispose of the bonds to the contractors, was not an indebtedness outstanding when the bonds were issued. This being so, the City Council had no alternative. The reason for such limitation upon official power is quite manifest. The bonds had failed to sell for par. Whether the contractors expanded their bids in their estimates or discounted the bonds cannot be known. What is certain is that they did not buy the bonds at par. That opportunity had been offered to all the world without a bidder. The statute limits the power of exchange to indebtedness already liquidated. Such indebtedness is itself a par. The exchange of the bonds, therefore, is an exchange of par for par. This cannot be said of a contract entered into which contemplated the acceptance of the bonds in payment for material and labor proposed to be furnished." (213 N. W. 401.)*

Special Rates Set up by Commission Are Declared Unconstitutional. — The Idaho Power Company brought suit in the United States District Court against the Public Utilities Commission of the State of Idaho to enjoin the enforcement of rates for electric service prescribed by the commission on the ground that they were confiscatory and unreasonable. The case was referred to a special statutory court, and the members thereof arrived at different valuation figures, but all agreed that special rates established by the commission for charitable institutions, water heating, air heating and for irrigation were invalid, except any which may have expired by limitation. The court issued an injunction against enforcement of these rates and held that with them enjoined and regular schedules applied to the services, the rates as a whole would not then be confiscatory. (19 Fed. (2d) 547.)

Commission Approval Necessary Before Entering New Territory.—Following are the conclusions of the Court of Appeals of Maryland overthrowing the decision of the Circuit Court of Baltimore that the Consolidated Gas, Electric Light & Power Company did not require the permission of the Maryland Public Service Commission to build lines to Havre de Grace and undertake to serve that city. This stage in the litigation brought against the Baltimore company by the Northern Maryland Power Company, which heretofore served Havre de Grace, was reported in the ELECTRICAL WORLD for July 30, page 230: "It was the clear and manifest purpose of the act of 1922 to require all gas and electric companies to obtain the approval of the commission before any initial construction of any extension into new territory. . . . When the appellee constructed its lines to Havre de Grace and over its streets it was undertaking to serve new territory which it does not appear to have had in contemplation until long after its incorporation and the passage of the public service law of 1910, and the records show no act of the appellee which could be construed into the exercise of its franchise from Short Lane to Havre de Grace and over the streets of Havre de Grace under its general charter at the time of the passage of the act of 1922. In the exercise of a state-wide or general electrical charter each town or aggregation of people in sufficient numbers to induce a corporation to look upon the territory as promising a profit should be regarded as a separate unit and not as a part of the whole state, to be served or not served at the pleasure of the corporation operating under such a charter. If the exercise of this sort of charter is delayed in any territory in the state, the delay is at the risk of legislation restraining, limiting or repealing the charter as to such unoccupied territory and subject to such regulations as may be imposed by statute."

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Idaho Commission Insists on Six Months' Notice of Rate Change — Favors Combination Rates.—In compliance with the order of the United States District Court noted on this page, the Idaho Public Utilities Commission adopted new schedules for the Idaho Power Company in place of those pronounced discriminatory but postponed their enforcement for six months, saying that equity and fair dealing required that reasonable notice be given to those who had enjoyed the lower rates before the advance became effective. The commission also adopted schedules of combination rates, optional with the consumer and covering (1) residential lighting and cooking, (2) residential lighting and refrigeration, (3) residential lighting, cooking and refrigeration, (4) residential lighting, cooking and water heating, and (5) residential lighting, cooking, water heating and refrigeration.

Reasons Governing Approval of Mergers.—In denying the application of the Metropolitan Edison Company to acquire eleven small light and power utilities serving rural sections of Pennsylvania (see ELECTRICAL WORLD for Aug. 6, page 279), the Public Service Commission of the state stressed what it considered unduly large figures in the purchase price, especially an allowance therein made for interest. In explanation of its attitude as contrasted with previous decisions the commission said: "The commission, recognizing the economies, improvement of service and possible reduction of rates which can be brought about by and usually follow the consolidation of detached electric companies with large and efficiently operated electric systems, has in a number of instances granted its approval of such consolidations when the purchase price was not in excess of or out of proportion to the fair value of the property acquired. In certain other instances, because of the strategic location of the companies to be acquired, approval has been given to purchase prices somewhat in excess of the depreciated values of the companies. In such cases the existence of other determining factors has convinced the commission that the public interest would best be served by permitting the acquiring company to absorb the costs involved, provided always that such costs imposed no unfair public burdens."

Men of the Industry

Roy T. Porter, superintendent of local operations of the Alabama Power Company in Montgomery, has been transferred to Decatur, Ala.

Roy Skill, formerly district manager of the Pacific Power & Light Company at Dayton, Wash., has been appointed to the Pasco office in the same capacity to succeed H. W. Cooper, who is now at Lewiston, Idaho.

R. J. Jenks, district manager of the Pacific Power & Light Company at Lewiston, Idaho, has resigned to engage in private business. H. W. Cooper, formerly district manager for the company at Pasco, Wash., will succeed Mr. Jenks, who will be retained in a consulting capacity.

A. R. Haynes, for the past sixteen years with the Puget Sound Power & Light Company at Dieringer, Wash., has been appointed electrical engineer, light division, department of utilities of the city of Tacoma. Mr. Haynes is the author of several technical articles on hydro-electric and steam-station operation.

F. W. Bedard has been appointed general manager of the Champaign-Urbana division of the Illinois Power & Light Corporation. Mr. Bedard was formerly connected with the electrical properties at Champaign, where in 1918 he became superintendent of what was at that time the Urbana & Champaign Railway, Gas & Electric Company.

Alfred D. Flinn, director of the Engineering Foundation, has been made the recipient of the honorary degree of doctor of science by the University of Louvain, Belgium, the award being incidental to that institution's centenary ceremonies. Dr. Edward Dean Adams received the diploma for Mr. Flinn, whose work for the Engineering Foundation necessitated a visit to the Pacific Coast at that time.

A. J. Nesbitt, well known in power circles throughout Canada, accompanied by James B. Woodyatt, vice-president of the Power Corporation of Canada and associated with Mr. Nesbitt in most of his hydro-electric interests, has just returned from a trip to France in connection with the Foreign Power Securities Corporation, Ltd. This is the second trip which Mr. Nesbitt has made to France this year.

P. A. Terrell, formerly district manager of the Jasper district of the Alabama Power Company, has been placed in charge of the company's new industries division in Mississippi. This division was organized last summer under the direction of T. D. Johnson, who had been engaged in this type of work for the Alabama Power Company for the past four years. The work of the division includes studies of markets, supply and cost of raw materials, transportation costs, labor, power and other items entering into the economic location of various industries within the territories served. **W. J. Porter,** formerly connected with the Grasselli Chemical Company, is in charge of the Gulf territories, and **Eugene Chatterton,** formerly connected with the commercial department of the Alabama Power Company's northern division, has charge of the South Carolina territory. **John B. Lagarde** of Anniston, an industrial engineer of wide experience, has affiliated himself with the industrial department.

H. W. Eales Joins the Byllesby Engineering Department

H. W. Eales, formerly chief electrical engineer of the Union Electric Light & Power Company, St. Louis, has been appointed head of the electrical engineering division of the engineering department of the Byllesby Engineering & Management Corporation, Chicago. Mr. Eales has occupied a prominent

H. W. EALES

place in the electrical industry as an executive engineer for many years. Last year, accompanied by W. H. Sawyer, president of the East St. Louis & Suburban Railway Company, he visited Australia with the purpose of making a survey of electric power resources there. Another important rôle was assumed by Mr. Eales when he became technical adviser on the process of design and construction for the great Cahokia power plant of the Union Electric Light & Power Company.

An Englishman by birth, Mr. Eales removed to this country at an early age and was graduated from Yale University in 1904. After pursuing his technical studies for three years he entered the employ of the General Electric Company, where he spent six years, two years at the company's factories and four years as engineer of the St. Louis office. In the spring of 1913 he was appointed assistant superintendent of distribution and assistant chief electrical engineer of the Union Electric Light & Power Company, St. Louis, later being promoted to be chief electrical engineer. Mr. Eales has been active in association work, being a fellow of the American Institute of Electrical Engineers and having served on various technical committees of the National Electric Light Association and the Association of Edison Illuminating Companies.

William Henry Patchell, British consulting engineer and past-president of the Institution of Mechanical Engineers of Great Britain, will arrive in this country next week, having sailed from England Aug. 11. As consulting engineer for a number of American public utilities, Mr. Patchell has visited the United States frequently, keeping in close touch with the latest developments here.

R. S. Phillips, general manager of the Arkansas General Utilities Company, Warren, Ark., a subsidiary of the American Utilities Company, Harrisburg, Pa., has been transferred to the home office in Harrisburg to become superintendent of production. **J. B. Bronson,** who has been commercial manager for the American Utilities Company on the properties in Missouri, Kentucky and Arkansas, has been promoted to be general manager of the Arkansas General Utilities Company, with his headquarters in El Dorado. Mr. Bronson had formerly been connected with the Dayton Power & Light Company.

Marcus A. Curran of New York, at present assistant to the vice-president of the Graybar Electric Company, has been elected vice-president and general manager of the Bryant Electric Company, Bridgeport, Conn. He will assume his new duties on Sept. 1. Mr. Curran is widely known in electrical trade circles, having been engaged in various phases of the electrical business. In 1911 he joined the Western Electric Company and, after holding various positions in the credit department in the Buffalo, Chicago, Indianapolis, Milwaukee and Minneapolis offices, he was appointed general credit manager, with headquarters in New York. He was later made manager of line material department, general staff, assistant manager Philadelphia office, manager of Omaha and Cincinnati offices and general staff manager of the central-station department. Shortly after the formation of the Graybar Electric Company he was made assistant to the vice-president of that company, which position he has held until the present.

Obituary

Wilhelm Biscan, one of the pioneers of electrotechnics in Austria and the founder at Komotau of the first school of electrotechnics in that country, died recently in Vienna at the age of 69.

Paul Spencer, electrical engineer, died at his home in Philadelphia, Aug. 10, in his sixty-second year. Mr. Spencer had been associated with the United Gas Improvement Company since 1900 and at the time of his death was in charge of its electrical operations in 28 states. He received his technical training at the Brooklyn Polytechnic Institute, Yale University and the Stevens Institute of Technology. Mr. Spencer was active in association work, having been a fellow and past-vice-president of the American Institute of Electrical Engineers, a member of the Franklin Institute, the Illuminating Engineering Society and the Engineers' Club of Philadelphia.

Financial and Statistical

General Trading Light
Utility Market Firm
Bond Undertone Sound

SHARP general advances in the price of securities on Friday of last week followed the reduction in rediscount rate by the Federal Reserve Bank of New York the preceding day from 4 per cent to 3½ per cent. The wave of buying was of short duration, for before the close of the day the market broke and a rush of selling ensued in the Exchange's biggest trading day of the year. Early this week the market attempted to regain its balance, and though trading has been dull at times, a broad recovery has set in and utilities' stock is in renewed demand. A mixture of gains and losses kept the index of common stocks computed by the ELECTRICAL WORLD at the same level as that recorded for the previous week—107. Gains were reported by Brooklyn Edison, Detroit Edison and the Edison Electric Illuminating Company of Boston and losses by the Commonwealth Edison, Philadelphia Electric and the Public Service Corporation of New Jersey.

Among the preferred shares that advanced were American Power & Light, showing a gain of three points; Southern California Edison, showing a gain of two points, and Adirondack Power & Light, showing a gain of one point. In the bond market the undertone continued firm, and little doubt exists of its fundamental soundness.

Continental Gas Plans Refinancing Program

With two major refunding issues hanging fire and the capital set-up of other subsidiaries subject to readjustment, the refunding operations of the Continental Gas & Electric Corporation will probably aggregate between $30,000,000 and $40,000,000. The Iowa & Nebraska Light & Power Company, which is controlled by the Continental, will offer a twelve-million-dollar issue of 5 per cent bonds. In addition, the Continental Gas & Electric Corporation is arranging for a refinancing issue for another subsidiary, the Columbia Railway, Power & Light Company. This company has called its first and refunding 5s of 1940 for payment Oct. 1.

German Utility Offers Fifteen-Million-Dollar Issue

One of the most extensive electric light and power systems in Europe, the Rhine-Westphalia Electric Power Corporation (Rheinisch - Westfälisches Elektrizitätswerk Aktien-Gesellschaft), entered the American market this week with an offering of 6 per cent direct mortgage gold bonds totaling $15,000,000. Of this total there have been reserved bonds to the amount of $4,000,000 for sale in markets outside of the United States.

These bonds, due in 1952, were priced at 95½ and interest, yielding 6.36 per cent. Proceeds will be used to reimburse the company in part for expenditures made in connection with important property additions and to provide funds for further acquisitions. The districts served constitute the most important industrial sections of Germany, lying in the valleys of the Ruhr, of the lower and central Rhine and of the Sieg River.

Columbia Gas & Electric Simplifies Set-Up

Several Small Subsidiaries to Be Retired as Soon as Properties Can Be Transferred to Other Companies—Important Saving Effected

WITH a view to introducing certain important economies in interest charges and in operating costs, the Columbia Gas & Electric Corporation has made further progress in the simplification of its capital structure. The changes made, it is claimed, will strengthen the investment position of the individual security issues remaining, as well as produce a better-balanced and more compact system.

Last May the corporation sold $40,000,000 of debenture bonds to retire several issues of obligations and underlying preferred stocks of the Columbia system, which had then been, or in the near future were to be, called for redemption at the earliest respective redemption dates, thus effecting a substantial reduction in the fixed charges of the system. Since that time virtually the entire proceeds have so been applied to the retirement of the 7 per cent preferred stock of Columbia Gas & Electric Company, the 5 per cent notes of the same company due May, 1928, but called for earlier redemption; United Fuel Gas Company 6 per cent bonds, Harrison Electric & Water Company 6½ per cent bonds, Southwestern Ohio Power Company 8 per cent preferred stock and Cincinnati Suburban Power Company 7 per cent stock. The option to purchase properties from the Hamilton Utilities Company, formerly operated under lease, was exercised, and through the subsequent dissolution of the Hamilton Utilities Company its common stock is liquidated, being equivalent to the retirement of an underlying stock issue of the Columbia system.

The policy of the company also contemplates further retirement of subsidiary company issues. Charleston-Dunbar Natural Gas Company first mortgage 6 per cent bonds and Cincinnati Suburban Power Company 6½ per cent bonds will be called at their next redemption date, which occurs next fall.

COMPANIES ALREADY DISSOLVED

The Ohio Gas & Electric Company, the Hamilton Utilities Company and the Cincinnati Suburban Power Company have been or are in progress of being dissolved, and similar action is contemplated in respect to several other subsidiaries from time to time as conditions permit. In certain cases the retirement of specific issues seems to be necessary before dissolution can be actually undertaken. It is evident from an analysis of the interest rate of the retired companies that a very material saving is being made through the process. The Columbia Gas & Electric Corporation is one of those public utility systems which have acquired individual properties at advantageous times. This naturally developed a system somewhat complicated in structure and would easily permit of the retirement of certain units which represent duplication of overhead and management, especially when some of these involve stocks and obligations sold to the public at a time when interest rates were from 1 to 2½ per cent higher than they are at the present time.

During 1926 there were withdrawn from the hands of the public nearly $19,000,000 par value of securities, including notes outstanding at the beginning of the year. This includes approximately $11,000,000 first mortgage bonds and debentures of the Columbia Gas & Electric Company (West Virginia) which became due January 1, 1927, as well as securities retired by sinking-fund operations and by voluntary purchases.

The consolidated income statement of the Columbia Gas & Electric Corporation and subsidiaries for the last calendar year shows gross earnings of $92,119,614. Expenses took $44,155,894, or 48 per cent. Total net earnings and other income amounted to $35,507,570. Total assets of the group now amount to slightly more than half a billion dollars.

Customer-Ownership Sales for May

Sales of stock on the customer-ownership plan in May amounted to 409,000 shares, valued at $24,000,000, in 46,500 transactions. This estimate is based on reports of companies having 86 per cent of the combined number of customers of all companies known to be selling stock locally.

The value is more than 25 per cent

Table I—Prime Movers, Motors and Generators in American Manufacturing Plants by

(United States Census of

Division and State	No. of Establishments Reporting Power	Prime Movers: Total Primary Horsepower	Steam Engines: Number	Steam Engines: Horsepower	Steam Turbines: Number	Steam Turbines: Horsepower	Internal-Combustion Engines: Number	Internal-Combustion Engines: Horsepower	Waterwheels and Water Turbines: Number	Waterwheels and Water Turbines: Horsepower	Electric Motors Driven by Purchased Energy: Number	Electric Motors Driven by Purchased Energy: Horsepower
United States:												
1925	167,649	35,772,628	74,691	11,434,388	7,485	5,482,468	14,362	1,186,116	8,393	1,800,828	1,724,180	15,868,828
1923	172,754	33,056,870	*90,019	*16,697,573	*.....	*.....	15,696	1,223,297	9,289	1,803,220	1,438 737	13,332,780
1919	222,253	29,297,963	116,017	13,834,016	6,438	3,197,599	30,437	1,240,868	13,976	1,765,031	972 062	9,260,449
Geographic Divisions:												
New England	16,628	4,349,191	5,862	1,080,002	949	720,265	694	38,866	3,222	777,472	209,547	1,732,586
Middle Atlantic	51,046	10,106,390	18,168	3,464,339	2,172	1,571,307	3,553	347,197	2,174	325,962	522,179	4,397,585
East North Central	38,324	10,047,780	16,825	3,014,432	2,093	1,748,513	3,083	395,788	1,330	245,364	501,924	4,643,683
West North Central	14,815	1,855,278	4,922	553,291	447	239,290	1,271	81,520	268	65,525	106,039	915,652
South Atlantic	15,159	3,454,150	10,516	1,073,426	590	393,842	2,121	150,250	887	292,285	157,878	1,544,347
East South Central	7,661	1,615,183	6,153	718,751	281	194,595	1,250	31,159	145	16,934	50,580	653,744
West South Central	7,284	1,316,933	5,684	652,730	334	203,829	1,276	93,453	31	2,837	37,050	364,084
Mountain	3,460	757,974	1,698	273,964	155	122,565	296	12,444	89	6,274	24,200	342,727
Pacific	13,272	2,269,749	4,863	603,453	464	288,262	818	35,439	247	68,175	114,783	1,274,420
New England:												
Maine	1,387	600,787	855	104,840	80	51,969	101	2,386	763	301,532	11,667	140,060
New Hampshire	985	370,740	543	78,881	56	79,615	81	2,765	510	162,183	6,126	47,296
Vermont	889	178,806	381	37,925	19	10,288	42	1,667	321	59,153	6,010	69,773
Massachusetts	9,052	2,013,017	2,652	563,017	455	372,808	295	11,545	1,020	176,934	117,049	888,713
Rhode Island	1,452	395,754	422	97,688	118	86,880	22	2,195	162	21,363	25,159	187,628
Connecticut	2,863	790,087	1,009	197,651	221	118,705	153	18,308	446	56,307	43,536	399,116
Middle Atlantic:												
New York	28,329	3,348,184	5,545	768,540	675	370,660	1,179	72,111	1,303	293,847	240,037	1,843,026
New Jersey	7,332	1,384,234	2,982	465,824	483	328,247	591	34,918	183	8,714	72,312	546,531
Pennsylvania	15,385	5,373,972	9,641	2,229,975	1,014	872,400	1,783	240,168	688	23,401	209,830	2,008,028
East North Central:												
Ohio	10,205	3,482,618	4,568	1,137,069	716	623,083	1,006	133,218	173	8,065	146,574	1,581,183
Indiana	4,429	1,420,989	2,399	311,718	209	292,361	339	163,210	132	7,802	62,590	645,898
Illinois	12,265	2,247,408	3,908	778,972	651	504,454	507	77,758	110	9,872	130,941	1,076,352
Michigan	5,205	1,887,750	2,508	438,353	335	438,862	323	8,959	266	40,138	113,487	961,438
Wisconsin	6,220	1,009,015	3,442	348,320	182	89,753	908	12,643	649	179,487	48,332	378,812
West North Central:												
Minnesota	3,519	508,021	1,388	133,336	128	90,220	203	20,510	110	55,908	23,985	208,047
Iowa	3,012	308,016	845	88,641	76	47,988	222	5,590	28	1,072	20,052	164,725
Missouri	4,571	590,485	1,609	194,208	109	33,965	357	18,397	38	986	40,300	342,929
North Dakota	301	16,711	80	4,544	11	5,463	53	1,826	10	85	1,296	4,793
South Dakota	458	21,463	117	6,559	7	2,650	48	986	6	293	2,046	10,975
Nebraska	1,203	133,708	274	46,901	44	14,451	133	4,935	34	2,382	7,848	65,039
Kansas	1,751	276,874	609	79,102	72	44,553	255	29,276	42	4,799	10,512	119,144
South Atlantic:												
Delaware	392	107,391	406	38,821	31	26,254	45	1,245	45	2,383	2,857	38,688
Maryland	2,808	544,558	1,598	109,473	134	65,165	329	79,892	67	4,690	24,909	285,338
District of Columbia	416	37,508	71	7,816	19	2,909	31	544	3	895	3,507	25,344
Virginia	2,396	441,807	1,685	139,401	90	73,768	215	9,657	334	34,070	16,086	184,911
West Virginia	1,295	431,981	901	158,766	66	79,854	324	32,174	38	8,295	11,401	152,892
North Carolina	2,545	800,051	1,928	202,569	86	46,419	181	6,958	225	175,517	49,833	368,588
South Carolina	1,088	423,359	988	153,593	54	37,779	74	1,992	84	39,061	20,530	190,934
Georgia	2,621	523,334	1,990	182,951	75	55,593	509	6,121	89	27,363	22,150	251,306
Florida	1,598	144,161	949	80,036	35	6,101	413	11,667	2	11	6,605	46,346
East South Central:												
Kentucky	1,734	257,965	873	91,957	35	18,941	226	6,564	34	1,852	11,969	138,651
Tennessee	2,031	447,529	1,532	170,958	89	60,855	139	5,091	97	3,870	18,616	206,755
Alabama	2,233	697,998	2,152	308,136	124	85,936	441	8,238	14	11,212	17,359	284,476
Mississippi	1,663	211,691	1,596	147,700	33	28,863	444	11,266	.....	.....	2,636	23,862
West South Central:												
Arkansas	1,207	177,011	1,256	117,600	39	20,020	161	8,188	6	76	3,527	31,127
Louisiana	1,609	410,298	2,178	272,735	117	50,882	283	18,480	7	125	7,138	68,076
Oklahoma	1,175	156,826	527	54,600	31	31,502	280	19,268	1	30	6,102	51,426
Texas	3,293	572,798	1,723	207,795	147	101,425	552	47,517	17	2,606	20,283	213,455
Mountain:												
Montana	540	166,528	217	29,224	8	3,650	46	1,078	4	2,350	4,566	130,226
Idaho	437	82,552	287	41,639	21	15,328	32	604	24	683	2,174	24,298
Wyoming	206	28,721	93	9,357	29	7,653	54	1,927	4	107	1,057	9,677
Colorado	1,252	219,865	589	109,434	44	17,417	80	1,405	13	662	8,388	90,947
New Mexico	190	18,842	102	12,968	7	1,718	22	1,271	.....	.....	485	2,885
Arizona	267	102,127	139	28,801	31	51,061	30	2,814	.....	.....	1,441	19,451
Utah	475	124,735	243	39,154	11	25,558	20	433	40	1,877	5,498	57,713
Nevada	93	14,604	28	3,387	4	180	12	2,912	4	595	591	7,530
Pacific:												
Washington	2,956	748,110	2,410	326,865	120	143,143	241	6,414	54	10,163	18,634	261,525
Oregon	1,734	387,749	1,057	135,933	46	57,406	148	6,782	129	50,087	11,351	137,541
California	8,582	1,133,890	1,396	140,655	298	87,713	429	22,243	64	7,925	84,798	875,354

* Steam turbines included with steam engines.

Table II—Prime Movers, Motors and Generators in American Manufacturing Plants by

Group and Industry	Number of Establishments Reporting Power	Total Primary Horsepower	Prime Movers: Steam Engines: No.	Steam Engines: Horsepower	Steam Turbines: No.	Steam Turbines: Horsepower	Internal-Combustion Egines: No.	Internal-Combustion Egines: Horsepower	Waterwheels and Water Turbines: No.	Waterwheels and Water Turbines: Horsepower	Electric Motors Driven by Purchased Energy: No.	Electric Motors Driven by Purchased Energy: Horsepower
All industries, total	167,649	35,772,628	74,691	11,434,388	7,485	5,482,468	14,362	1,186,116	8,393	1,800,828	1,724,180	15,868,828
Industrial Groups												
Food and kindred products	43,180	3,881,952	16,035	1,417,989	642	242,342	4,661	177,417	2,126	109,392	215,059	1,934,814
Textiles and their products	22,372	3,986,136	4,249	1,101,373	752	755,822	336	19,068	2,054	460,951	317,906	1,648,922
Iron and steel and their products, not including machinery	5,923	7,518,999	6,158	3,035,612	1,183	1,428,871	754	599,456	211	19,050	138,507	2,436,010
Lumber and allied products	20,623	3,472,770	21,065	2,088,709	640	404,891	2,652	57,959	749	48,448	100,339	872,763
Leather and its manufactures	3,901	413,759	1,144	158,004	74	54,099	82	4,434	79	4,955	41,412	192,267
Rubber products	462	656,857	345	82,487	108	145,617	14	294	25	3,241	21,793	425,218
Paper, printing and related industries	23,305	3,060,794	3,182	672,942	601	422,689	721	12,020	2,255	934,372	234,012	1,018,771
Chemicals and allied products	7,354	2,984,913	10,621	948,151	2,242	681,773	1,036	79,468	117	154,596	72,549	1,120,925
Stone, clay and glass products	7,915	2,348,157	3,961	571,508	288	366,406	1,753	111,836	163	29,096	57,654	1,269,311
Metals and metal products, other than iron and steel	5,500	1,158,486	940	236,573	170	194,627	240	20,947	71	7,299	56,766	699,040
Tobacco manufactures	732	42,075	142	21,038	12	4,100	11	73	6	207	6,141	16,657
Machinery, not including transportation equipment	11,482	2,714,377	2,225	377,454	314	355,738	1,098	63,762	395	22,166	216,843	1,895,257
Musical instruments and phonographs	421	97,318	174	34,434	24	23,255	19	748	4	220	7,148	38,661
Transport. equipment, air, land, water	2,722	1,888,961	1,214	271,920	220	308,773	354	16,766	31	1,487	132,521	1,290,015
Railrood repair shops	2,035	942,248	1,898	286,340	164	66,264	147	4,823	3	32	36,495	584,789
Miscellaneous industries	9,722	604,826	1,338	129,854	51	27,201	484	17,045	104	5,316	69,035	425,410

States—January 1, 1926

Manufactures)

Electric Motors Driven by Current Generated in Establishment Reporting		Electric Generators	
Number	Horsepower	Number	Kilowatts
772,445	10,254,745	23,635	6,887,045
616,020	8,819,217	.....	.....
486,130	6,965,174	.....	.....
120,546	1,234,115	3,197	992,470
250,689	3,128,254	6,517	1,992,423
263,698	3,520,410	7,630	2,136,254
33,827	501,012	1,413	346,150
52,044	777,182	1,924	586,451
12,618	201,001	777	213,418
13,491	287,961	1,119	235,634
6,347	137,475	364	120,147
19,185	467,335	694	264,098
7,999	150,991	316	131,143
12,973	181,647	278	143,582
2,605	32,730	116	28,9282
61,429	577,135	1,428	429,406
12,662	101,550	340	92,507
22,878	190,062	719	166,904
75,666	710,377	2,084	508,905
53,022	511,347	1,381	422,123
122,001	1,906,530	3,052	1,061,395
58,378	1,151,619	1,727	632,580
32,742	633,770	674	342,715
59,901	724 385	1,559	431,721
76,424	650,578	2,804	499,739
36,253	360,058	866	229,499
8,636	154,518	318	119,136
6,537	84,503	243	58,556
12,826	144,113	489	85,438
316	5,072	25	4,058
82	3,949	9	2,405
1,856	31,908	94	19,563
3,574	76,949	235	56,994
2,701	40,553	79	27,497
6,462	213,117	219	89,438
162	2,387	22	2,078
17,123	129,470	402	98,317
6,461	156,339	342	123,889
8,611	82,037	297	97,259
5,908	77,140	201	66,776
3,916	62,986	254	67,589
700	13,153	108	13,608
4,437	43,913	188	32,306
4,121	60,440	256	67,551
3,026	66,697	187	81,226
1,034	29,951	146	32,335
1,697	28,983	152	23,585
3,463	85,776	363	77,031
1,928	46,991	150	32,150
6,403	126,211	454	102,868
432	12,808	33	5,199
578	18,294	47	14,842
374	6,773	32	6,433
2,008	34,860	112	28,094
381	6,237	21	3,833
1,561	39,428	44	43,405
852	16,281	52	15,150
161	2,794	23	3,141
7,489	250,017	287	133,539
3,861	91,736	132	59,472
7,835	125,582	275	71,087

Groups of Industries

Electric Motors Driven by Energy Generated in Establishments Reporting		Electric Generators	
Number	Horsepower	Number	Kilowatts
772,445	10,254,745	23,635	6,887,045
61,694	630,451	3,539	462,238
149,965	1,042,363	2,884	993,955
109,121	2,953,810	2,051	1,450,275
54,520	836,036	2,544	576,277
18,731	133,028	638	114,424
11,941	193,484	207	132,713
41,716	884,872	1,833	679,365
48,093	771,057	2,010	608,894
25,460	624,131	1,380	463,414
18,597	263,936	587	253,993
3,162	14,974	85	14,978
120,150	927,720	2,019	526,716
5,676	49,522	127	28,527
74,642	593,851	2,474	379,983
16,748	260,938	882	142,451
12,229	74,572	375	58,842

in excess of similar sales in May, 1926, and also somewhat exceeds the estimate for April, 1927, revised in the light of information received after publication. The average sale per transaction, about $520, is smaller than any in the recent past, but the number of transactions underwent a decided increase. The average value per share is under $60, although nearly $18,000,000 of the total sales were at or very close to $100 per share. Two important properties, however, had heavy sales of much lower-priced stock, around $25 and $40 respectively, thus reducing the average.

Electric Generators in Private Plants Total 6,887,045 Kw.

ACCORDING to a United States Census Bureau report just issued, there were on Dec. 31, 1925, a total of 167,649 manufacturing establishments in the nation using power. This shows a decrease of 5,105, or 3 per cent, from Dec. 31, 1923, two years previous. The installed primary power of these plants on Dec. 31, 1925, totaled 35,772,628 hp., a gain of 2,715,758 hp., or 8.2 per cent, during the two years since the previous census was taken. Of the various types of power prime movers in use, steam engines lead with a reported installation of 11,434,338 hp., a decrease of 2,399,628 hp., or 17.4 per cent, during the six-year period 1919-1925. On the other hand, the installation of steam turbines showed an increase of 2,284,869 hp., or 71.7 per cent, during the same period. Both internal-combustion engines and waterwheels showed a decrease from 1923 to 1925, but the installation of electric motors run by purchased energy showed a gain of 2,536,048 hp., or 19 per cent, during the same two-year period.

The number of electric motors installed in manufacturing plants on Dec. 31, 1925, totaled 2,500,625, with a combined rating of 26,123,573 hp. This is an increase of 445,868 motors and an increase in installed motor rating of 3,971,576 hp., or 18 per cent, since Dec. 31, 1923. During the two-year period the rating of motors run by privately generated energy increased by 1,435,528 hp., or 16.3 per cent, while the rating of motors run by purchased energy increased by 2,536,048 hp., or 19 per cent. Therefore, while the increase in rating of motors run by energy purchased from public utilities was about twice that of the motors run by energy generated in private power plants, yet the growth in private electrical generating plants is still of large proportions.

This Census of Manufactures makes available for the first time official data on the rating of electric generators in private power plants. The figure on Dec. 31, 1925, is given as 6,887,045 kw. A survey by the ELECTRICAL WORLD indicated that on Jan. 1, 1924, the total rating of installed generators in private plants was approximately 5,000,000 kw. The census figures indicate that the ELECTRICAL WORLD figure for Jan. 1, 1924, was a little low. The production of energy by these private plants was not ascertained by the Census Bureau, but the findings of the ELECTRICAL WORLD survey would indicate that their production of electrical energy during 1925 totaled around 15,920,000,000 kw.-hr. According to the ELECTRICAL WORLD, the total sale of electrical energy by central-station companies for power purposes during 1925 was 29,578,000,000 kw.-hr., indicating that the total consumption of electrical energy by manufacturing plants during that year was 45,498,000,000 kw.-hr., of which about one-third was generated in private power plants.

Securities Called in August Total $5,500,400

Securities of electric light and power companies called for payment in August in advance of maturity totaled only $5,500,400, as compared with $70,696,500 in July. Only one issue exceeded the million-dollar mark—the 4½s of 1929 of the North Boston Lighting Properties, amounting to $1,500,000. Issues called in entirety totaled $4,567,300. The companies involved follow:

Issue	Due	Amount
North Boston Ltg. Properties, 4½s	1929	$1,500,000
Northwest Public Service, B6s	1950	916,000
Eastern States Utilities, 6½s	1948	500,000
People's Light & Power, 6s	1935	400,000
Fort Payne Utilities, 6s	1945	250,000
Lee Electric of Iowa, 6s	1940	221,300
Huron Light & Power, 6s	1937	190,000
Beaverton Power, 1st 6s	1944	130,000
Dalhert Ice & Electric, 8s	1931	100,000
Minnesota Elec. Lt. & Pwr., 6s	1940	360,000
Philadelphia Company, 6s*	1944	397,600
Electrical Securities, 5s*	1953	296,000
United Electrical Securities, 5s*	1944	90,000
Connecticut Lt. & Pwr., B5½s*	1954	58,000
Harrison Electric & Water, 6½s*	1944	31,000
Taylorsville Gas & Elec, 5s*	1935	26,500
Roanoke Traction & Lt., 5s*	1958	19,000
Springfield Lt., Ht. & Pwr., 5s*	1929	15,000

[4] Not entire issues.

Pennsylvania Company Changes Capital Set-up.—At a meeting of the stockholders of the Eastern Utility Preferred Holding Corporation (previously called the Pennsylvania Electric Corporation) the stockholders, representing over 99 per cent of the common shares and 67⅓ per cent of the preferred shares, approved certain transactions, which are now being carried through. Holders of the corporation's outstanding seven-dollar preferred stock are offered for subscription, share for share, 75,000 shares of prior preference stock at $97 per share and accrued dividends. Each share of prior preference stock will carry a non-detachable warrant entitling the holder thereof to receive without additional cost one-half share of class A stock. Also attached to each share of prior preference stock will be a detachable warrant entitling the holder to purchase one share of seven-dollar preferred stock. Payment for full

shares subscribed for may be made in five installments. Interest of 5 per cent per annum on each installment will be credited on the last installment.

Associated Stockholders Increase

In line with the practice of many larger companies, the Associated Gas & Electric Company has for some time been keeping a record of the distribution of its outstanding class A stock. A tabulated list showing the total number of shareholders and the total number of shares by dividend dates since the first quarter of 1925 is as shown below:

Date	Number of Shareholders	Total Shares	Average per Shareholder
Mar. 30, 1925	2,377	200,000	84.1
June 30, 1925	3,221	258,716	80.3
Sept. 30, 1925	3,354	272,886	81.4
Dec. 31, 1925	3,814	272,886	71.6
Mar. 30, 1926	4,314	300,000	69.5
June 30, 1926	4,152	300,000	72.3
Sept. 30, 1926	4,514	300,000	66.5
Dec. 30, 1926	4,921	336,822	68.5
Mar. 30, 1927	6,323	500,000	79.1
June 30, 1927	7,373	500,000	67.8

From March 31, 1925, to June 30, 1927, two years and one-quarter, the number of shareholders increased from 2,377 to 7,373. The holders of less than 100 shares increased from 2,110 to 6,591. Between the last two dividend dates the total shareholders increased from 6,323 to 7,373, an increase of nearly 1,000 shareholders with no increase in the total number of shares outstanding, and the number of holders of less than 100 shares increased from 5,642 to 6,591 shares.

This comparison takes no account

Company Reports

Name of Company	Gross Revenue Twelve Months Ended June 30 1927	1926
Adirondack Power & Light	$9,499,316	$8,829,791
American Power & Light	61,913,987	55,889,070
American Wtr. Wks. & Elec.	47,154,666	43,333,284
Associated Gas & Electric	32,376,230	26,848,635
Bangor Hydro-Electric	1,815,078	1,643,949
Baton Rouge Electric	1,011,446	892,762
Binghamton Lt., Ht. & Pwr.	2,043,125	1,819,878
Blackstone Valley Gas & Elec.	5,748,455	5,317,640
Central Illinois Light	4,334,597	4,049,346
Central Maine Power	5,328,096	4,946,259
Cities Service	29,275,842	21,590,142
Columbus Elec. & Power	3,986,322	3,249,690
Commonwealth Power	51,455,349	46,786,688
Community Power & Light	4,192,211	3,811,755
Consumers Power	25,537,927	22,416,015
Detroit Edison*	22,295,985	20,601,922
Eastern Texas Electric	6,532,390	4,696,814
Edison El. Ill. Co. of Brockton	1,862,256	1,706,491
Electric Light & Power Co. of Abington & Rockland	592,764	569,672
El Paso Electric	2,916,634	2,672,059
Engineers Public Service	28,306,109	24,847,538
Federal Light & Traction*	3,508,725	3,287,189
Florida Public Service	1,808,065	1,424,905
Fort Worth Power & Light	2,869,884	2,866,912
Galveston-Houston Electric	4,853,176	4,162,335
General Gas & Electric	25,511,446	22,411,282
Illinois Power	$2,612,172	$2,574,154
Kansas City Power & Light	11,493,900	10,559,605
Lowell Electric Light	1,760,702	1,682,138
Metropolitan Edison	10,038,220	9,201,368
Nebraska Power	4,606,889	4,264,686
Nevada-California Electric	5,059,762	4,880,451
New Bedford Gas & Ed. Lt.	4,243,120	4,087,464
New Jersey Power & Light	2,614,569	1,929,108
North Carolina Pub. Service	2,305,286	1,905,170
Northern Ohio Power	12,304,176	11,808,448
Northern Texas Electric	2,574,694	2,483,118
Ohio Edison	1,877,824	1,700,623
Pacific Power & Light	3,694,048	3,704,928
Penn.-Ohio Edison	13,281,426	11,837,555
Portland Electric Power	12,059,283	11,321,430
Public Service Co. of N. H.*	1,752,461	852,998
Public Service Co. of N. J.	110,427,255	100,983,856
Puget Sound Power & Light	14,253,130	13,143,782
Savannah Electric & Power	2,251,778	2,109,306
Southern California Edison	29,780,860	26,043,517
Southern Indiana Gas & Electric Co.	2,986,171	2,788,252
Tampa Electric	4,854,672	4,283,846
Tennessee Electric Power	12,209,918	11,806,145
Texas Power & Light	8,739,020	7,182,265
Virginia Electric & Power	15,063,039	13,303,725
West Penn Electric	36,076,919	32,845,377

* Six months ended June 30.

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Aug. 9	Low 1927	High 1927
ABITIBI PWR. & PAPER, 4% com.—no par	102¼	83	104¼
Adirondack Pwr. & Lt.—7% pf.	112½	107	113½
Adirondack Pwr. & Lt.—8% pf.	114	112	116
Ala. Pwr., $7 cum. pf.—no par	110½	107	112½
Allis-Chalmers Mfg.—7% pf.	m111½	109	112½
Allis-Chalmers Mfg., 6% com.	107½	88	111½
Aluminum Co. of Amer., com.	k 90	67¾	105
Aluminum Co. of Amer., 6% of	104	101¼	104½
Amer. & Foreign Pwr., pf. 25% pd	m110	....	....
Amer. & Foreign Pwr., 7% pf.—no par	100	86½	102
Amer. & Foreign Pwr., com.—no par	21½	18½	25½
Amer. Bosch Magneto, com.—no par	20½	13	22½
Amer. Brown Boveri Elect.	13	10½	39½
Amer. Brown Boveri Elec., pf. $7	54	50½	98
Amer. Gas & Elec., 6% pf.—no par	k101	95½	101½
Amer. Gas & Elec., com.†—no par	95½	68½	100½
Amer. Lt. & Trac., 6% pf.	115	108	133
Amer. Lt. & Trac., new com.	k165½	164½	177
Amer. Pwr. & Lt., 6% pf.	105	97½	106½
Amer. Pwr. & Lt., com.†—no par	60	54	67
Amer. Pub. Serv., 7% pf.	a 99	94	104
Amer. Pub. Serv., com.†	75	45	100
Amer. Pub. Utilities, 7% ptc. pf.	a87½	73	88½
Amer. Pub. Utilities, 7% pr. pf.	a 92½	92	96
Amer. Pub. Utilities, com.	55	65	70
Amer. States Sec., A	2½	2½	4½
Amer. States Sec., B	2½	2½	4½
Amer. Superpwr., 6% ptc pf.—25	k29	26½	29½
Amer. Superpwr., 6% 1st pf.	f 98	....	....
Amer. Superpwr., Class A†—no par	k 35½	28½	38½
Amer. Superpwr., Class B†—no par	k 36	28½	39½
Amer. Wtr. Wks. & Elec., 7% pf.	k111½	104½	111½
Amer. W. W. & E., com. $1.60—20	k 99	62½	99
Anaconda Copper cap. $3	46½	41½	49½
Appalachian Electric Pwr., 7% pf.	102½	98	103½
Appalachian Elec. Pwr., com.	78	77	83
Arizona Pwr., 7% pf.	78	77	84½
Arizona Pwr., com.	20	....	....
Arkansas Pwr. & Lt., 7% pf.	101	....	....
Assoc. Gas & Elec., $3.50—50	51	....	....
Assoc. Gas & Elec., pf.—$6—no par	92	85	93
Assoc. G. & E., Class A, 10—no par	41½	35	43
BABCOCK & WILCOX, 7% com.	114	113	123
Binghamton L., H. & P., $6 pf.	98	94	100
Birmingham Elec., pf.—$7—no par	107½	105	109
Blackstone Valley G. & E., 6% pf.	101½	100	106
Blackstone Valley Gas & Elec., 10% com.—50	k135	98	153
Blaw-Knox, com.†	f 74½	70	75
Brazilian Trac., Lt. & pwr., com.†	m170½	....	....
Broad River Pwr., 7% pf.	100	97	103
Brooklyn Edison, 8% com.	177½	148½	179
Buffalo, Niagara & East. Pwr., $1.60 pf.—25	f 25½	....	....
Buffalo, Niagara & East. Pwr. com. $1—no par	f 34½	....	....
CALIFORNIA ELEC. GENERATING, 6% pf.	96½	92	99
California Ry. & Pwr., 7% pf.	130	98	150
Carolina Pwr. & Lt., pf.—$7—no par	f109	107	109
Central & S.W. Util., $7 pf.—no par	a 96	93½	97½
Central & S.W. Util., pr.ln.$7 pf.—no par	a102	98½	104½
Central Ariz. Lt. & Pwr., 8% pf.	k 97	95	98
Central Ark. Ry. & Lt., 7% pf.	102	100	104
Central Ill. Pub. Serv., $6 pf.	a91½	88½	95½
Central Ind. Pwr., 7% pf.	93	84	95
Central Pwr. & Lt., 7% pf.	101	100½	103
Central States Elec., 7% pf.	95	93	96
Central States Elec., com.†	m200	....	....
Century Elec., 6% com.	m115	115	115
Chicago Fuse Mfg., com.—$2.50 no par	a 33½	30	35
Cincinnati Gas & Elec., 5% com.	g 99½	96½	100
Cities Service, $6 pf.—no par	f 88½	87½	90½
Cities Service, pf. B—no par	f 8½	7½	f 8½
Cities Service, pf. BB—no par	f 82½	81	85½
Cities Service, com.—20	f 47½	40½	58½
Cities Service, Bks. Shrs.—10	f 23½	22½	29½
Clarion River Pwr., 8% pf.	95	....	....
Cleveland Elec. Illg., 6% pf.	110½	108	123
Cleveland Elec. Illu., 10% com.	320	285	330
Columbia Gas & Elec., 6% pf.	106½	99½	107½
Columbia G. & E. com. $5—no par	95½	82½	98½
Columbia Ry., Gas & Elec., 6% pf.	98	97	100
Columbus Elec. & Pwr., $2 com.—no par	64	....	....
Columbus Ry., Pwr. & Lt., 6% 1st pf.	102	98½	102½
Columbus Ry., Pwr. & Lt., 6½% pf. B	101	96	103½
Columbus Ry., P. & L., com.—no par	100	75	105
Commonwealth Edison, 8% com.	a152	138	155
Commonwealth Pwr., 6% pf.	99½	91½	100
Commonw'th Pwr., $2, com.—no par	57	48½	57
Conn. Lt. & Pwr., 8% pf.	121	119	123
Conn. Lt. & Pwr., 7% pf.	k115	112	118
Cons. Gas of N. Y., pf.	k 99	93	99
Cons. Gas of N. Y., com $5—no par	110	94	112½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf.	k105	105	107
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf.	e112½	110½	113
Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf.	k110	111	115
Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf.	e128½	127	129½
Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $2.50—no par	e 60	51	62
Consolidated Pwr. & Lt., 7% pf.	k105	100	106
Consumers Pwr., 6% pf.	101½	100	102
Consumers Pwr., 6.6% pf.	105	103	105½
Continental Gas & Elec., 8% ptc. pf.	108	103	106½
Continental Gas & Elec., 7% pr. pf.	102	100	103
Conti. G. & E. com. $4.40—no par	k210	210	225
Crocker Wheeler, com.†	26	30	38
Crocker Wheeler, 7% pf.	k84	78	88
DALLAS PWR. & LT., 7% pf.	109	107	110½
Dayton Pwr. & Lt., 6% pf.	k106	101	107
Detroit Edison, 8% com.	149½	133½	157
Dubilier Condenser, com.—no par	k3½	3½	5½
Duquesne Lt., 7% pf.	116½	114½	116½
EASTERN NEW YORK UTIL., $7 pf.	105	103	107
Eastern New York Util. com.	65	60	70
Eastern States Pwr., $7, com.	8	9	13
Eastern States Pwr., pf.	90	90	95
East. Tex. Elec., 7% pf.	107	106	108
Edison Elec. of Boston, $12 com.	d234½	217	267
El Paso Elec., 7% pf.	107	105	107½
Elec. Bond & Share, 6% pf.	k109½	105½	109½
Elec. Bd. & Sh. Sec., com. $1—no par	f 74½	67½	79½
Electric Household Util.†	a 12½	11	15½
Elec. Investors, 6% pf.—no par	95	92	96
Elec. Investors, com.†—no par	36½	32½	40½
Elec. Investors, 10% pd. receipts	m 15	....	....
Elec. Pwr. & Lt., ctfs. pf.	105	96	106½
Elec. Pwr. & Lt., ctfs., 40% pd.	114½	103½	115
Elec. Pwr. & Lt., ctfs, full pd.	m114	108½	111½
Elec. Pwr. & Lt., ctfs., com.—no par	22½	16½	23½
Elec. Refrig. cap.†	15½	12½	37½
Elec. Ry. Securities, com.—no par	m 7	....	....
Elec. St. Battery com. $5.25—no par	72½	63½	79½
Elmira Wtr., Lt. & R.R., 7% pf.	102	98	103
Emerson Elec., pf.	m109	107½	111
Empire Pwr., ptc.†	35	26	39
Engr. Pub. Serv., $7 pf.—no par	104½	93½	106½
Engr. Pub. Serv., com.—no par	28½	21½	29½
Eureka Vacuum Cleaner, com. $4—no par	76½	60½	77
FAIRBANKS MORSE, 7% pf.	k108	107½	112
F.-M., com.—$3—no par	k 38	37½	43½
Federal Lt. & Trac., com. $1.40	41½	37½	47
Federal Lt. & Trac., $6 pf.—no par	k 99	91½	99½
Ft. Worth Pwr. & Lt., 7% pf.	f111	108	112
GALVESTON-HOUSTON ELEC. 6% pf.	73	68	72
Galveston-Houston Elec., com.	24	28	32
Gen. Elec., $3 com.—no par	123½	81	131
Gen. Elec., special—6%	11½	11	11½
Gen. Gas & Elec. (Del.) com. A. $1.50—no par	41	34	47½
Gen. G. & E. (Del.) com. B—no par	m 44½	35½	44½
Gen. G. & E. (Del.) pf. A. $8—no par	k117	113½	120
Gen. G. & E. (Del.) pf. A $7—no par	k108½	100	109½
Gen G. & E. (Del.) pf. B $7	k103	96	105
Gen. Pub. Serv., $7 cum. pf., no par	k107	102	106
Gen. Pub. Serv., com., no par	k 13½	11½	15½
Ga. Lt., Pwr. & Rys., 6% pf.	93	82	96
Ga. Lt., Pwr. & Rys., com.	f 50	50	80
Ga. Ry. & Pwr., 8% pf.	k123	119	125
Ga. Ry. & Pwr., 7% pf.	k113	106	110
Gt. Western Pwr., 7% pf.	h103	....	....
IDAHO PWR., 7% pf.	107	103	109
Ill. No. Utilities, 6% pf.	a 97	92	97
Ill. Pwr. & Lt., 7% pf.	101	99	101
Ingersoll Rand com. $8	k 90	88½	98½
Int. Combus. Engr., com. $2—no par	48½	43½	64
Int. Util., Class A—$3.50—no par	39½	28	41½
Int. Utilities, Class B—no par	5½	3	7½
Interstate Pwr., pf.—$7—no par	94	93	98
Interstate Pub. Serv., 7% pf.	99½	97	101
Iowa Ry. & Lt., 7% pf.	98	95	100
JERSEY CENTRAL PWR. & LT. CO., 7% pf.	101½	97½	103
Johns-Manville, com.†—no par	94½	55½	98

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, Aug. 6 lBid price Wednesday, Aug. 10. mLatest quotations available. †Dividend rate variable.

of the distribution of approximately 40,000 shares held in a single name which are being held for employees who are paying for it under an "employees' stock purchase plan," nor of considerable amounts held in the names of brokers and other nominees for large numbers of small holders.

New Capital Issues

First mortgage and refunding 5 per cent gold bonds, series E, of the Central Illinois Public Service Company were offered during the week ended Aug. 11 at 97 and interest, yielding 5.20 per cent. These bonds, dated May 1, 1926, and maturing May 1, 1956, were priced at 97 and interest, yielding 5.20 per cent.

Electric Investors, Inc., issued 15,000 shares of preferred stock of no par value at $96.75 per share and accrued dividends, to yield 6.20 per cent.

Connecticut Company's Stockholders Granted Rights. — Directors of the Union Electric Light & Power Company, Unionville, Conn., have voted to increase the capital stock from $750,000 to $900,000 at par ($50). Stockholders of record July 26 have the right to subscribe Aug. 16 for one share of new stock at $50 for every five shares held. Payment for new stock is due Aug. 25. This is the second increase in capital made by the company this year, the first change having been made Feb. 15, 1927, when stock having a par value of $150,000 was issued.

Cities Service Preferred to Change to No Par.—Stockholders of the Cities Service Power & Light Company will meet next month to vote on changing all the preferred stock from $100 par value to no-par-value shares. The shares will remain the same in all other features. Shareholders of the Cities Service Company this spring approved changing the par-value preferred issues to no-par issues. These consisted of 1,030,647 shares outstanding of $6 preferred, 413,770 shares of preference B preferred and 57,754 shares of preference BB preferred. The preferred and the preference BB were changed from $100 par and the preference B from $10 par value.

Canadian Company Issues Stock.—Cumulative preferred stock of the Montreal Island Power Company, totaling $1,000,000 and bearing interest at the rate of 6 per cent, has recently been offered at 98, to yield 6.12 per cent (carrying a bonus of four shares of common stock with each ten shares). The company was incorporated in the Province of Quebec with the purpose of developing a water-power site on the Rivière des Prairies, about seven miles from the heart of the city of Montreal.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Aug. 9	Low 1927	High 1927
KANSAS CITY PWR. & LT. pf.$7	k114	112	115¼
Kansas Gas & Elec., 7% pf.	l106	103	107
Kentucky Hydro-Elec., 7% pf.	a 98½	94½	98½
Kentucky Sec.,6% pf.	k 84	83	87
Kentucky Sec., 5% com.	109	110	115
Kentucky Utilities, 6% pf.	98½	93	100
Keystone Pwr. & Lt., pf.	98	95	100
LACLEDE GAS LT., 12% com.	k 235	173½	267½
Lehigh Pwr. Sec., com.—no par.	18	15	20
Long Island Ltg., 7% pf.	110	107½	112
Long Island Ltg., com.†—no par	145	140	150
Los Angeles Gas & Elec., 6% pf.	k103	98	104
Louisville Gas & Elec., cl. A. $1.75	27	23½	27½
MAN. ELEC. SUPPLY, cap. $5 —no par.	124½	53½	132
Manila Elec., com.†—no par.	k 42	40	46
Maytag Mfg., com. .50—no par.	33½	23½	33½
Memphis P. & L., pf.—$7—no par	109	105	110
Metropolitan Ed., pf.—$6—no par.	99½	93	100
Metropolitan Ed., pf.—$7—no par.	108	104	108
Metropolitan Ed., com. $5—no par.	70	....	....
Middle West Utilities, 7% pf.	a110½	105½	113½
Middle West Util., 8% pr. lien	a121½	117½	122½
Middle West Util., com. $6—no par ex. div.	a110½	108	117½
Midland Utilities, pr. in. 7% pf.	a104½	92½	104½
Midland Utilities, 7% pf. A	a104½	98	106
Milwaukee Elec. Ry. & Lt., 7% pf.	k102	100	103
Milwaukee Elec. Ry. & Lt., 6% pf.	k 98	98	101½
Minn. Pwr. & Lt., 7% pf.	l105½	104	107
Miss. Pwr. & Lt., $8 pf.	m101	106	103
Miss. River Pwr., 6% pf.	101	94	103
Miss. River Pwr. 3% com.	62	....	....
Mohawk Hudson Pwr., 1st pf.—$7 —no par.	k106	100	109
Mohawk Hudson Pwr., 2d pf.—$7 —no par.	k110	98	112
Mohawk Hudson Pwr., com.—no par	29½	20½	32½
Montana Pwr., 7% pf.	m106½	118½	106½
Montana Pwr., 5% com.	104	81½	106½
Montreal Pwr., 7% com.	f 84	....	....
Mountain States Pwr., 7% pf.	k100	97	101
Mountain States pwr., com.†	18	....	....
NASSAU & SUFFOLK LTG., 7% pf.	106	98	105
National Carbon, 8% pf.	a139½	130½	139½
National Elec. Pwr., A†	a 24½	23½	25½
National Lt., Ht. & Pwr., com.	24	22	27
National, Light, Ht. & Pwr., 5% pf.	72	70	74
National Pwr. & Lt., pf.—$7—no par	k106½	101	108½
National Pwr. & Lt., com.†—no par.	21½	19½	23½
National Pub. Serv., 7% pf.	97	93	100
National Pub. Serv., 7% ptc., pf.	113	108	115
National Pub. Serv., A com. $1.60— no par.	k 22½	18½	24
National Pub. Serv., B com.—no par	k 18½	14	20½
Nebraska Pwr., 7% pf.	l109½	106	109
Nevada-Calif. Elec., com.	k 26	22	27
New Brunswick Pwr., 4% pf.	62	50	65
New Eng. Pub. Serv., pr. in. pf. $7.	102	96	103
New Eng. Pub. Serv., pf. $7	97	88	99
New Orleans Pub. Serv.—7% pf.	104	103	105½
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	k 94	91	97
N. Y. Central Elec., 7% pf.	101	98	102½
Newport News & Hampton Ry., Gas & Elec., 5% com.	109	....	....
Newport News & Hampton Ry., Gas & Elec., 7% pf	109	....	....
Niagara Falls Pwr., 7% pf.—25.	28½	27½	29½
Niagara, Lock. & Ont. Pwr., 7% pf.	109	105	112
No. Amer., 6% pf.—50.	55	50	55
No. Amer., com.—10	49	45½	52½
No. Amer. Edison, $6 pf.—no par.	k101½	96½	101½
No. Caro. Pub. Serv., pf.—$7—no par	101	93	102½
Northeastern Pwr., com.	k18½	14½	20
No. N. Y. Utilities, 7% pf.	106	103	109
No. Ohio Pwr., com.—no par.	12½	9½	13½
No. Ohio Trac. & Lt., 6% pf.	80	75	83
No. Ohio Pwr. & Lt., 7% pf.	92	90	95
No. Ont. Lt. & Pwr., 6% pf.	k 91	84	95
No. Ont. Lt. & Pwr., 4% com.	k 72	73	78
No. States Pwr., (Del.) 7% pf.	104	101	107½
No. States Pwr., (Del.) 8% com.	121	109½	124
No. Texas Elec., 6% pf.	k 66	65	70
No. Texas Elec., com.	22	27	36
OHIO BRASS, com. B $4—no par.	73	72	78
Ohio Brass, 6% pf.	101	100	104
Ohio Pwr., 6% pf.	101	97	103
Ohio Pub. Serv., $6 pf.	98	95	100
Ohio Pub. Serv., 7% pf.	106	103	109
Ohio River Edison, 7% pf.	108	103	109½
Oklahoma Gas & Elec., 7% pf.	100	...	....
PACIFIC GAS & ELEC., 6% pf.	26½	24½	26½
Pacific Gas & Elec., 8% new com.	37½	31	39½
Pacific Pwr. & Lt., 7% pf.	l104	102	104
Penn Cent. Lt. & Pwr., $5 pf.—no par	c 75½	75½	77
Penn-Ohio Edison, 7% pf.	102½	97½	104½
Penn-Ohio Elec., 7% pf.	m101½	98	100
Penn-Ohio Pwr. & Lt., 7% pf.	106½	99	103
Penn Pwr.& Lt.—$7—no par.	l108½	107	108½
Penn Wtr. & Pwr., 8% com., new.	c 58	47½	58
Phila. Co., 6% pf.—50.	k 52	50	53
Phila. Co., com.—50.	k 103	85½	110
Phila. Elec., 8% com.—25.	c 51½	46½	54
Portland Elec. Pwr., 7% pf.	98	97½	101
Portland Elec. Pwr., 6% pf.	k 79	78	83
Portland Elec. Pwr., 6% 2d pf.	60	55	70
Portland Elec. Pwr., com.	25	22	30
Potomac Elec. Pwr., 6% pf.	j108½	....	....
Pwr. Corp. of N. Y., com. $1—no par	m 79	....	....
Pwr. Sec., pf.—no par.	k 28	28	33
Pwr. Sec., com.—no par.	k 6	5	8
Public Serv. of Colorado, 7% pf.	l102	....	....
Pub. Serv. of N. J., 6% pf.	k101	98½	101½
Pub. Serv. of N. J., 8% pf.	k131	125	132
P. S. of N. J., $2 com.—no par.	42½	32	45½
Pub. Serv. of No. Ill., 6% pf.	a105	101½	106
Pub. Serv. of No. Ill., 7% pf.	a116½	112½	117
P. S. of No. Ill., com. $8—no par.	a139	130½	143
Pub. Serv. of No Ill., $8 com.	a140	132	142
Pub. Serv. of Okla., 7% pr. in.	101	97	102
Pub. Serv. Elec. & Gas, 6% pf.	107½	102	108½
Puget Sound Pwr. & Lt., 7% pr. pf.	107	105	107
Puget Sound Pwr. & Lt., $6 pf.—no par.	87½	83½	89
Puget Sound Pwr. & Lt., com.	33	28	35½
RADIO CORP. OF AMER., $3.50 pf.—50.	52½	49	53
Radio Corp. of Amer., com.—no par.	63½	41½	65
Republic Ry. & Lt., pf.	m120	....	....
Republic Ry. & Lt., com.	m135	112	135
Rochester Gas & Elec., 6% pf. D	k104	101	103½
Rochester Gas & Elec., 7% pf. B	107	105	107
Rochester Gas & Elec., 6% pf. C	104½	101½	103½
SAFETY CABLE, com. $4.	71½	52½	74½
San Joaquin Lt. & Pwr., 7% pr. pf.	99	96	101
St. Joseph Ry., L., H. & P., 5% pf.	72	65	75
Servel Corp.	1½	1	10½
Sierra Pacific Elec., 2% com.	k 26	24½	28½
Sioux City Gas & Elec., 7% pf.	101½	99	104
Southeastern Pwr. & Lt., pf.—$7 no par	l105	....	....
Southeastern Pwr. & Lt.,pfe.pf.	l 78	....	....
Southeastern Pwr. & Lt., com.—no par	37½	29½	38½
So. Calif. Edison, 8% pf.	39½	35	41
So. Calif. Edison, 7% pf.	28½	27½	29
So. Calif. Edison, 6% pf.	25½	24½	25½
So. Calif. Edison, 8% com.	35½	31½	36½
Southern Cities Utilities, 7% pf.	73	67	90½
Southern Cities Utilities, com. $4.	27	22½	42½
Southwestern Lt. & Pwr., A $3.	k 65	60	65
Southwestern Lt. & Pwr., B.	k 65	60	65
Southwestern Lt. & Pwr., $6 pf.	k 85½	83	91½
Southwestern Pwr. & Lt., 7% pf.	k109	103	110½
Springfield (Mo.) Ry. & Lt., 7% pf.	101	96	103
Standard Gas & Elec., 8% pf.	k 63	57½	64
Standard Gas & Elec., 7% pr. pf.	106	103	110
Standard G. & E., com. $3.50—no par.	62½	54	65½
Standard Pwr. & Lt., 7% pf.	100	98	102½
Staten Island Edison, pf.—$6—no par.	k100½	99	101
Superheater, $6 com.—no par.	169	170	185
Syracuse Lighting, 7% pf.	107	105	110
Syracuse Lighting, 8% pf.	115	113	119
Syracuse Lighting, 8% com.—no par	m300	....	....
TAMPA ELEC., com. $2.	k 58½	49	64
Tenn. Elec. Pwr., 6% pf.	97	92	97
Tenn. Elec. Pwr., 7% pf.	107	103	107½
Terre Haute, Ind. & East. Trac., 5% pf.	22	15	35
Terre Haute, Ind. & East. Trac., com	1	1	9
Tex. Pwr. & Lt., 7% pf.	l109	106	109
Tide Water Pwr., 8% pf.	109	105	110
Timken Roller Bear., com.—$4 no par.	129½	78	142½
Toledo Edison, 8% pf.	115	112	116½
Toledo Edison, 7% pf.	k106½	....	....
Toledo Edison, 6% pf.	k 98	95	97
Toledo Edison, 6% com.	100	....	....
Tri-City Ry. & Lt., 6% pf.	97	85	99
UNITED GAS & ELEC., 6% pf.	k101	98	102
United Gas & Elec., com.—no par.	m 57	....	....
United Gas & Elec. (N. J.) 5% pf.	71	70	73
United Gas Impr., 8% com.—50.	c 111½	89½	113½
United Lt. & Pwr., pf.—$4—no par.	52	46	55
United Lt. & Pwr., pf.—$6.50—no par.	95	84	99
United L. & P., com. A .48—no par.	13½	12½	15½
United L. & P., com. B .48—no par.	k 17	16	18
Utah Pwr. & Lt., 7% pf.	l 107	104	108½
Utica Gas & Elec., 7% pf.	105	105	106½
Utica Gas & Elec., 8% com.	60	....	....
Utilities Pwr. & Lt., 7% pf.	95½	93	100
Utilities Pwr. & Lt., com. A $2.	30½	27	34
Utilities Pwr. & Lt., com. B $1—no par.	17½	13½	19
VERMONT HYDRO-ELEC., 7% pf.	98	93	100
Virginia Elec. & Pwr., 7% pf.	107	104	110
Virginian Pwr., 7% pf.	k108	....	....
Virginian Pwr., com.	k 75	....	....
WAGNER ELEC., 7% pf.	b 87	68	90
Wagner Elec., com.—no par.	b 33½	18½	39½
Washington Ry. & Elec., 5% com.	j256	....	....
Washington Ry.& Elec.,5% pf.	j 92	....	....
Washington Wtr. Pwr., 8% com.	159	131	170
West Penn Elec., 7% pf.	110	102	112
West Penn Elec., Cl. A $7.	k108	97½	110
West Penn Pwr., 7% pf.	114½	111	118
West Penn Pwr., 6% pf.	m107½	100½	108½
West Virginia Lt., Ht. & Pwr., 7% pf.	90	94	96½
West Va. Utilities, 7% pf.—50.	m 90	48	51½
Western Pwr., 7% pf.	k 99	98	101½
Western States Gas & Elec., 7% pf.	k101½	96	103
Western States Gas & Elec., com.	m 37	....	....
Westinghouse Elec. & Mfg., 8% com. —50.	84½	67½	89
Weston Elec. Instrument, Cl. A $2 —no par.	k 31	30	34½
Weston Elec. Instrument, com.—no par.	13½	13½	18½
Wheeling Elec., 6% pf.	100	92	103
Worthington Pump, 7% pf. A.	k 52	46	61½
Worthington Pump, 6% B.	45½	40	54½
Worthington Pump, com.	36½	20½	46
YALE & TOWNE com. $5—25.	k 84½	70½	82½

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Manufacturing and Markets

Where Stands German Industry?

Germany Has Made Tremendous Progress Industrially and Against Heavy Handicaps—Hampered by Conditions, Further Progress Is Difficult

By Edward J. Mehren
Vice-President McGraw-Hill Publishing Company, Inc.

"WHAT is happening in Germany?" has been a leading question with Americans ever since the war. During the inflation period we were disturbed at the low-priced goods she shipped to us. Her competition is still felt in some of our home markets, while reports of her activities in industrial consolidation and cartels prompt frequent repetition of the question. An exact but brief answer is not easy to give. The evidence in some matters is conflicting, indicating that there is still unsettlement. Nevertheless, the general situation can be stated briefly, and answers hazarded to those obvious collateral questions, Whither is the Reich going? How far will it go?

To begin with, let us build a background. Here is a nation that had grown to industrial greatness in a generation. She had become one of the leaders in international trade. Everywhere was the German commercial flag. Then she was pushed from her high estate. Through the Versailles Treaty she lost 13 per cent of her area, 10 per cent of her population, 20 per cent of her coal mines, 74½ per cent of her iron ore and 68.3 per cent of her zinc ore. Her colonies were seized, her merchant shipping wiped out, her foreign investments largely confiscated. But that was not all. Inspired by the new nationalization growing out of the war, and crystallized by the application of the theory of "self-determination of small nations," custom barriers sprang up all over Europe and cut off markets. Russia practically disappeared as a buyer, and British colonies adopted empire-preference policies.

Meanwhile, the unrest following a revolution (something we are apt to forget) had torn the country. Class was set sharply against class, and social legislation, far-reaching in type and cost, was enacted. Finally, the mark took a long slide to nothingness, completing the wreckage of the economic structure. In 1920 the political rebuilding of the Reich was started; in 1923, through the stabilization of the mark, the economic.

Progress Rapid

First, let it be said that the progress has been astonishing. I was in Germany in 1920, when everything was at a low ebb. I was there again in 1924, eight months after the mark had been stabilized, when hope had again been kindled in the German breast, but when only the beginnings of progress were visible. What a contrast now! The industries are effectively organized, the workers are fairly well satisfied and are working diligently, the general spirit of unrest and discontent have disappeared, though some claim that this is only on the surface, and, above all, there is a drive and a spirit of sacrifice and devotion among the leaders and managers of industry and trade that is inspiring. They do not know how long it will take to reach a truly stable economy, with the workers on a satisfactory standard of living and with industry on a reasonable net earning basis. But the immediate tasks are clear, and to their solution the leaders of German commerce, industry and engineering are applying tremendous energy, intelligence and patience. They are working hard and thinking hard.

The workers in large part have recovered from their post-war radicalism and are working with an industry that wins general approval from employers. They, too, have caught the spirit of sacrifice, as shown in the answer they give to questions about their economic condition. "Yes," they reply, "we can get along." Possibly one should decribe their attitude as one of resignation to inevitable conditions; yet the reply is often followed by an expression of confidence in the future. At least, if the worker's attitude lacks the fire shown by the leaders of industry and trade, the acceptance of conditions, except in communistic circles, is without resentment.

Just now business is quite active. Mills and factories are running to good capacity. The number of unemployed, which reached 2,000,000 in January, 1926, has gradually declined, standing at 649,000 at the end of May. But it is feared by some close students of industry that the present demand for goods will not keep up. The stimulated production is for German use and not for export, and these students failed to see a sound basis for heavy internal buying. The present improved situation is due largely to the British coal strike and to some extent to the Russian orders taken last year. The British strike created a demand for German coal, and its production, in consequence, ran above that of 1913, excluding the lost areas. The mines, in turn, bought new equipment, headworks, etc., thus stimulating the steel trade. The machinery industry even today remains active, though new inquiries are dropping off. Had the steel production been for export, the situation would be brighter. The situation has been helped, too, by orders for ship steel, the builders desiring to take advantage of the subsidy, which applies only to ships built this year. The Russian orders helped, but were of much less importance than the strike stimulus. While, therefore, the condition just now is favorable, as compared with the situation late in 1925 and early in 1926, the economic condition is still abnormal and must remain so for many a year.

A Definite Program in Hand

Though not formulated in one place, there is a definite program in hand in Germany, a program that is obvious, one might declare, because it is forced by necessity, but a program, nevertheless, that deserves recognition and study. The crux of the situation is the need for export trade, and, secondly, for an export trade balance. For the first Germany must make goods that other countries either cannot or do not make, or do not make of equal quality, or, for equal quality, she must make goods cheaper. Other countries must need some German products so badly that they will take the goods over their own tariff walls, and, in turn, Germany must manufacture other goods so well and cheaply that the goods can leap the barriers. Secondly, imports must be reduced, relatively at least; Germany must produce and manufacture as much as she possibly can at home.

Cost Reduction Efforts

Heading all cost reduction efforts is the solid German front of scientific and industrial research which has been renowned for more than a generation. Suffice it to say that its intensity and breadth have been increased under the economic urge pressing on the country. To be noted especially is the attention being given to what might be called research in pure science—the effort to explore new areas and to conquer new realms in the domain of science. Mr. Hoover has repeatedly emphasized the need for such research, in addition to research directed at immediate practical ends. Here in Germany research in pure science is in full blossom, not only in university laboratories, but within factory walls. For example, in one chemical plant I visited, employing 15,000 men, there are 300 people in the laboratory, and of these 100 are engaged in research in pure science. These 100 have no concern with the technical problems of the plant, nor necessarily with new products. Their duty is to explore and to push out far beyond the practicalities of the day. It is for the management to have faith that some day and in some way the bread thus cast upon the waters will come back. Be it remarked, too, that such confidence in the past has not been disappointed.

Germany has made tremendous progress industrially and against heavy handicaps. She is, however, hampered by conditions that make further prog-

ress difficult and slow. She is putting forth great effort, and it is making her industrially strong. Eventually, she will play an important part in the world's commercial affairs. She is adaptable and fits herself perfectly into the conditions and requirements of modern industrialism.

For us in the United States the lesson would seem to be this: Just now the competition of Germany will not have serious concern for the American people at large; but as our need for foreign markets grows and Germany's handicaps are reduced German competition will be of deep concern to us. Let it not be looked forward to as commercial or industrial warfare. It is but the competition that we as Americans expect among ourselves; to the most intelligent, the most efficient, shall go the reward. So, too, in the future competition in foreign trade. Germany will be a worthy rival; the tools of competition will be the research laboratory, studies in waste reduction, researches to discover new methods and new products, and, finally, hard and intelligent work. We are stimulating Germany now to high endeavor in engineering enterprise and industrial management. She will, in turn, stimulate us. Our future position as against Germany will depend on your technical ability and commercial alertness.

Probably I can do no better than to conclude with the observation made to me by that able German Dr. Carl Duisberg, head of the great I.G. chemical company. "America," he said, "can undoubtedly keep the economic leadership of the world for twenty or thirty years if her young people are taught to work." I took him to mean that in that period Germany would be in a position to challenge our leadership, though this he did not say. In Dr. Duisberg's emphasis upon work is the deep secret of Germany's potential strength. For hard work there is no substitute—and that lesson the Germans have learned.

Trade Commission to Study Resale Price Maintenance

The decision of the Federal Trade Commission to investigate all phases of resale price maintenance has created a great deal of interest. "Nothing that the Federal Trade Commission could possibly do at the present time would excite more interest than the commission's proposal to investigate all the economic, legal and business angles of resale price maintenance and resale price cutting," said Gilbert H. Montague in discussing this branch of the commission's activity.

"For ten years the courts have been working further and further into the fog," said Mr. Montague. "Last May, in the American Tobacco case, the Supreme Court of the United States in effect served notice that it could give no further enlightenment on this subject. Several Circuit Courts of Appeals have in recent years judicially expressed the extreme difficulty they have experienced in understanding and applying hair-line distinctions that now separate lawful from unlawful resale price maintenance. All this has, in recent years, greatly augmented resale price cutting and enormously increased the difficulties of manufacturers, distributors and dealers whose best advertised lines are the subject of this price cutting. Nobody in the country, outside these manufacturers, distributors and dealers themselves, has had closer contact with this subject than the Federal Trade Commission, for the commission is the governmental body that today is primarily charged with the duty of enforcing the present law against illegal methods of resale price maintenance. That the Federal Trade Commission should, in spite of all this, be willing to investigate the economic, legal and business angles of the very law that it now is enforcing is an extraordinary instance of broadmindedness and good sportsmanship."

Fowler Gets McGraw Award

Contractor-Dealers' Medal and Purse Are Presented at St. Louis Meeting of Electragists

THE contractor-dealers' medal and purse for 1927 given under the James H. McGraw award were presented this week at the convention of the Association of Electragists International, Chase Hotel, St. Louis, to Joseph A. Fowler. The presentation was made in recognition of Mr. Fowler's constructive contribution to the advancement of the contractor-dealer branch of the electrical industry by personally interpreting to the national associations of the manufacturers, jobbers and power companies the present economic and trade problems of the contractor and dealer and by his leadership winning for them new understanding and support throughout the industry.

The committee of judges which awarded the medal to Mr. Fowler consisted of James R. Strong, Walter H. Taverner, C. C. Bohn and W. Creighton Peet. The committee of awards consists of W. W. Freeman, H. B. Crouse, W. E. Robertson, L. K. Comstock, F. M. Feiker and Earl Whitehorne.

In 1926 the medal and purse were awarded to L. K. Comstock, and certificates of honorable mention were extended to Arthur L. Abbott, Charles E. James and G. Fred Laube. The medal was withheld in 1925, but certificates of honorable mention were extended to A. Penn Denton, Robert A. Goeller, Walter H. Taverner and William J. Ball. No honorable mentions were made this year. The citation follows:

Joseph A. Fowler, president of the Fowler Electric Company, Memphis, long a progressive leader in thought and action in the cause of the electrical contractors and dealers of the country, was elected president of the Association of Electragists International in 1925 and served for a period of two years. During this time he devoted himself to the task of personally interpreting to the national associations of the manufacturers, jobbers and power companies of the electrical industry the present economic and trade problems of the contractor and dealer, in the endeavor to bring to their attention and concern the increasing mutuality of interest between the four branches of the industry which is now fast developing in this expanding era of intensive marketing dependent so largely upon the adequacy of house wiring and the merchandising of appliances. By the force of his appealing personality, the vigor of his expression in correspondence and published articles and by his gift of public speaking in addresses before industry gatherings of all kinds, in all parts of the country, he has impressed upon all classes of electrical men the urgent need for the closer co-ordination of the contractor and dealer in their relationships with the other groups, and by the spirit of his leadership he has won for them new understanding and support throughout the industry.

In recognition of this very distinguished contribution to the advancement of the contractor-dealer branch of the electrical industry, the judges have awarded to Mr. Fowler the contractor-dealer medal and purse for 1927, given under the James H. McGraw award.

Business Conditions

PURCHASING of electrical and allied equipment is not heavy in any part of the country, but the general average is steady and manufacturers show no signs of pessimism. In the Northwest are planned some hydro plants, and specifications are being written for a large lumber and paper mill and grain elevator. Purchases of electric ranges and equipment for extending domestic service feature Pacific Coast buying. Utility buying is in good volume in the Southeast, and textile mills are showing interest in new equipment. Industrial buying is fairly good in New England, and utilities are in the market for considerable electrical materials. Business in the New York district is steady but quiet. Industrial activity has increased slightly in the Middle West, and utilities are continuing construction despite conservative policies. In both the Northeast and Southeast considerable interest is being manifested in improved or extended illumination for streets, airplane landing fields, railroad yards, and office buildings. Lamps and appliances, except fans, are moving fairly well in the Middle West.

Metal Markets Quiet Down —Sentiment Improved

A reaction occurred this week from the activity and strength that have characterized the metal markets recently. Most of the large copper producers have continued quoting 13⅜ cents delivered to usual Eastern points of consumption. But this quotation has become almost nominal, prices as low as 13.2 cents and 13.25 cents delivered being necessary to tempt most consumers. Some copper was sold in the Middle West as high as 13¼ cents.

The only change in the lead situation is a slight softening of the price in the

NEW YORK METAL MARKET PRICES

	Aug. 3, 1927 Cents per Pound	Aug. 10, 1927 Cents per Pound
Copper electrolytic	13⅜	13.05
Lead, Am. S. & R. price	6¾	6.75
Antimony	12	12
Nickel, ingot	35	35
Zinc spots	6.775	6.725
Tin, Straits	65	65.25
Aluminum, 99 per cent.	26	26

Base copper price Aug. 10, 1927, 15½ cents.

St. Louis district, where some metal is obtainable at 6.475 cents or possibly 6.45 cents. One important seller reports increased buying on the part of storage-battery makers who need metal for prompt delivery. Though the price of zinc has reacted from the high of 6.45 cents of a week ago, selling for as low as 6.30 cents, St. Louis, in the week ended Aug. 10, a slightly firmer tendency is now noted, with most producers quoting 6.35 cents.

Motors and Lighting Equipment Feature New England Buying

Equipment sales in the Northeast are being maintained in excellent volume. While motor sales are below last year's figures, power companies are in the market for considerable electrical material and industries are buying fairly well. Recent sales include a 10,000-kva. synchronous condenser to operate in an atmosphere of hydrogen, a 200-hp. motor, 100 fractional-horsepower motors for machine-tool operation, and 66 capacitors, completing an industrial installation of 100 3-kw. units. Outdoor switching equipment totaling about $20,000 was ordered for use in northern Maine, and a 200-kw. portable kenotron set was purchased by a Massachusetts central-station company. A 50-kw. resonant control system was approved for use in Boston street-lighting service. The Boston & Maine Railroad is installing about 36 floodlighting units for the modernization of yard lighting, and the Rutland Railroad has purchased seven floodlights with steel-tower supports for its St. Albans yard. Interest is increasing in the illumination of aviation fields.

Jobbers are doing a fair business. One house reports a transformer order of about $12,000, with a ready sale of fiber conduit and a moderate demand for interior wiring supplies. Retail appliance sales are holding up well, and improved sales are reported by leading refrigerator makers. An interesting lighting job is under way at Fitchburg, Mass., where 47 municipal buildings are being modernized as to wiring and illumination, with improved street lighting expected to follow soon. A total of about $30,000 will probably be expended on the former, and the latter will include the replacement of cluster-type units by high-powered gas-filled lamps. A Hartford manufacturer has purchased a 20-kw. pot furnace, and other houses have bought a 36-kw. electric varnish kettle and an 18-kw. pitch kettle.

Southeastern Utilities and Textiles Buying in Good Volume

Activities in the electrical field in the Southeast continue satisfactory, with central-station companies buying in good volume. The largest individual order was from Alabama for $200,000 worth of oil circuit breakers, while the Carolinas were represented with a power-plant switchboard order totaling $22,000. A Georgia company ordered last week $15,000 worth of transformer equipment, the orders calling for 100-kva. subway transformers, 50-kva. and 75-kva. outdoor transformers and small power and distribution transformers. Other sizable central-station orders were for $8,000 worth of 5, 10 and 25-amp. meters for stock, $7,700 worth of No. 6 weatherproof, medium-hard, solid copper wire and $5,100 worth of protective apparatus. One of the most interesting orders placed last week was for $16,000 worth of floodlighting equipment for a Georgia flying field.

Home-lighting plant sales in Georgia are noticeably off, while the movement of small water-pumping plants is brisk, and both are the direct result of the expansion activities of the larger power companies in the state. The increase in the water plants more than offsets the decrease in the lighting plants. Gin motors have been active, and their sales this year to date have been very satisfactory. A textile plant in Georgia ordered last week inside construction materials amounting to $5,000 for use in an addition to plant, while another textile mill in this state closed contract for purchased power and will electrify its plant, the electrical materials involved being approximately $25,000. Business prospects in the tobacco belt are excellent.

New York Buying Quiet but Steady

Sales to public utility companies in the New York district continue generally quiet but steady. No single orders of remarkable magnitude are reported, but there is a sufficient amount of small orders to keep manufacturers from being pessimistic. Transformer sales fell off last week, but a good volume of inquiries for quotations were received, and orders are expected to follow later this month. Poles, cross-arms and line hardware are quiet, both in sales an inquiries. Switching equipment and circuit-breaker sales are steady, and inquiries indicate an increase of activity in these lines. The demand for transformers among industrial buyers is good, and a fair demand is also reported for small and medium-size motors. Jobbers' sales are spotty, appliances being particularly weak.

Hydro-Plant and Industrial Buying in Wind in Northwest

Construction of 11 miles of service lines and wiring of 80 homes, 30 of which will take electric ranges, has been announced by the Pacific Power & Light Company. The Tacoma Land & Improvement Company plans immediate construction of a dam and pipe-line costing $50,000 and utilizing the waters of Bear Creek. The Federal Light & Traction Company has started preliminary work on a proposed ten-million-dollar hydro-electric power project in southwestern Washington. Motor and apparatus sales during past week to lumber mills and manufacturing plants have been extremely light, but jobbers report fair-sized sales of smaller motors to out-of-town distributors, particularly in eastern Washington for pumping plants and cold-storage installations. It is reported that specifications are being written for motors and equipment for a lumber mill at Centralia recently destroyed by fire, for a 30-ton (daily capacity) paper mill, costing about $150,000, at Kelso, and for a grain elevator and terminal planned by the Port of Kelso, Washington, to cost $416,000. Light sales of wire, schedule materials, ranges and domestic appliances are reported throughout the entire Puget Sound section with no indications of improvement until the early fall months.

Coast Purchases Service Equipment and Ranges

The week on the Pacific Coast has been prolific in large orders of standard apparatus and material, such as two carloads of ranges valued at $35,000, for San Joaquin Valley distribution and one and one-half carloads of house-type wattmeters, valued at $30,000, for the East Bay region. Other excellent orders include a 1,000-kw. General Electric turbo-generator with condenser and auxiliaries, totaling $35,000, for a Hawaiian Island sugar plantation, and a 200-hp. synchronous motor and a large switchboard, totaling $5,000, for a local plant. Power-company business includes many small lots of pole-line hardware averaging $500 each for delivery to particular jobs and an unusually large number of orders for distribution transformers (sizes 1½ kw. to 200 kw.), probably an accumulation of work. Contractors' orders for roughing in and wiring material are very good, the effect being shown by a rising market. Dealers' orders for radiators and holiday hollow ware are now being solicited.

Middle West Utilities Continue Conservative Construction

General business in the Middle West continues to improve gradually, with industrial activity increasing slightly. Utility companies, while continuing a conservative policy, are undertaking considerable construction work necessitating apparatus purchases. Among the interesting orders placed this week were the following: Construction of superstructure for high-tension transformer structure valued at $65,000, two feed-water systems, four turbine-driven boiler-feed pumps with appurtenances, four 500-kva. single-phase transformers, two 6,000-amp. 15-kv. isolated-phase oil circuit breakers, 66 2,200-volt induction motors, ten 230-volt motors valued at $200,000, one 335,000-lb. railroad scale, 3,000 domestic watt-hour meters, 1,010 Thompson meters and lamps valued at $150,000. Jobbers' sales continue to increase with general business, although not to any marked degree. Increased purchasing of the railroads and industrials, however, is being noticed.

There has been no great change in conditions in the St. Louis district, but the tone is still good. No orders of size worthy of special mention have been noted during the past week. A small consignment of transformers was shipped into northeastern Oklahoma for distribution service in one of the small cities. The demand for line and construction material continues in good volume, and several good-sized orders have been shipped to northern and eastern Arkansas. Contracts have been closed on several of the large wiring jobs in St. Louis, and there are more to be heard from in the next week or two. Electrical appliances are moving out in especially good quantity for the mid-summer.

Activities of the Trade

Welding Patents of Holslag and Arendt Are Consolidated

The alternating-current welding patents owned by the Electric Arc Cutting & Welding Company, 152 Jelliff Avenue, Newark, known as the Holslag patents, and the inductive reactor alternating-current patents, known as the Arendt patents, owned by the Owen Electric Manufacturing Company, Fayetteville, N. C., have been consolidated into one license arrangement. Mr. Holslag, in commenting on this patent consolidation, said that for several years a doubt has existed regarding the true ownership of rights to the use of alternating current for arc welding owing to a possible conflict in the Arendt and Holslag patents. Both Mr. Holslag and Mr. Owen have been active in the development of alternating-current welding since 1911. Mr. Holslag says that in his experience there is more electric welding by alternating current done in this country, Canada and abroad at the present time than by all the other methods of electric welding together.

American Brown Boveri Sells Two Constituent Concerns

B. W. Kerr, Greensburg, Pa., and associates have concluded arrangements with the American Brown Boveri Electric Corporation, 165 Broadway, New York, for the purchase of the Electrical Development & Machine Company and the Railway & Industrial Engineering Company, manufacturer of electric switching equipment for heavy duty, etc. Mr. Kerr was president of the Railway & Industrial company when it was purchased by the American Brown Boveri organization in February, 1926, and in taking over the property again will occupy the same position. It is proposed to continue production as heretofore under the new management, and expansion in output is said to be under consideration.

Servel Receiver Explains Purpose

Colonel Frank E. Smith, who, together with Courtlandt Nicoll, was recently appointed* receiver of the parent Servel Corporation and its New York subsidiaries, and who with Frank R. Wilson and Fred P. Nehrbas was also appointed† receiver of the two Indiana subsidiaries, issued the following statement on Aug. 5:

"The receiverships of the various Servel Corporations are a step toward a reorganization, the details of which are now being worked out by the creditors, and, it is hoped, will very shortly be announced. The receivers will continue the business pending the reorganization. The new Electrolux-Servel absorption-type refrigerator, which operates from gas, electricity or any other controllable heat, is giving entirely satisfactory results and meeting with very favorable reception throughout the country."

Since that statement an agreement has been reached upon a plan for reorganization of the Servel Corporation and its subsidiaries and a syndicate has been organized which is prepared to underwrite the plan. The reorganization committee will consist of George W. Davison, president of the Central Union Trust Company, as chairman; Nicholas F. Brady, Albert H. Wiggin, chairman of the board of the Chase National Bank, C. M. Kittle, president of Sears, Roebuck & Company, and Murray H. Coggeshall.

The application for receivers for the Servel Corporation was made by T. R. Pugh, a creditor to the amount of $10,000. This followed the appointment of Mr. Smith and F. P. Nehrbas, vice-president of the Old National Bank of Evansville, Ind., as receivers for the same corporation at that city, on application of the Kirkpatrick-Heim Printing Company, alleging non-payment of $4,000. In his application, Mr. Pugh indicated that the assets of the concern are about $9,000,000, and stated that an equity receivership was asked only to safeguard the creditors.

James H. Douglass, attorney for the Servel Corporation, asked that two subsidiary corporations also be put under the receivership. The subsidiary companies are the Servel Corporation of New York and the Absorption Refrigerating Company, Inc.

While admitting that the corporation's assets exceed its liabilities, the complaint charges that the Servel company is unable to liquidate its assets or get additional cash from the banks in order to meet its obligations.

*By Judge Goddard of the United States District Court for the Southern District of New York.

†By Judge Edgar S. Durre in Indiana.

Brown Boveri Contract Canceled

The contract between the American Brown Boveri Electric Corporation and Brown Boveri & Company, Ltd., has been mutually canceled, it was announced on Aug. 9. W. M. Flook, chairman of the board of the American company, sailed for Europe Aug. 10 to negotiate with the European company regarding their future relationship and possibly draw up a new contract.

Chicago and Illinois Wire Merger

The Chicago Insulated Wire & Manufacturing Company, Sycamore, Ill., has been merged with the Illinois Wire & Cable Company of the same city to effect greater economies in the operations of the two plants and provide a single company of greater strength than either of its components.

The Chicago Insulated Wire & Manufacturing Company is one of the oldest wire-manufacturing companies in the United States, having been established in 1885. Its old plant was destroyed by fire in 1919, and since then a modern plant has been erected. The Illinois Wire & Cable Company has been in existence about fifteen years, has a very vigorous organization and is likewise well known in the trade. With the two companies combined A. B. Gochenour, president of the Chicago Insulated Wire & Manufacturing Company, expects to be in a better position than ever before to serve the trade.

The Edwin F. Guth Company, 2615 Washington Avenue, St. Louis, announces that Hollis R. Johnson has joined its central-station division and will be in charge of the campaigns that will be conducted in the Southwestern division of the United States. Mr. Johnson was formerly with the Commercial Electrical Supply Company, St. Louis and Stone & Webster, Inc., Boston.

The American Electric Switch Corporation, Minerva, Ohio, has been organized and incorporated with an authorized capitalization of $1,000,000. J. C. Lewis is president, Arthur Koch treasurer, and E. F. Rinoehl secretary. The corporation will manufacture a varied line of safety switches, fuse panels, panelboards and switchboards. All parts and mechanisms as well as boxes will be manufactured in the company's factories at Minerva.

Vaughan Engineers, a consulting organization formerly located at 185 Devonshire Street, Boston, has moved to the Waterman Building, 44 School Street, with offices on the tenth floor.

The John A. Roebling Sons Company, Trenton, N. J., wire manufacturer, has approved plans for the construction of an addition to its wire and cable works. It will be one-story, L-shaped, 90 ft. by 400 ft., and 60 ft. by 70 ft.

The Electrical Production Corporation, Los Angeles, has acquired the Pacific Coast electrical sign business of the Federal Electric Company, according to an announcement by Paul D. Howse, president of the former company. The purchasing company operates factories at Los Angeles, Oakland, Seattle, Portland, Fresno and Denver, and through these units hereafter will serve the Federal Electric Company's sign customers.

The American Rolling Mill Company, Middletown, Ohio, manufacturer of electrical sheet steel and other products, announces through G. M. Verity, president, that it has acquired the property, plants, business and patents of the Columbia Steel Company and the Forged Steel Wheel Company at Butler, Pa., and Elyria, Ohio. The Columbia Steel Company will, for a period as yet undetermined, be operated as a separate company, but the entire product will be sold by the American Rolling Mill Company under its trade name "Armco."

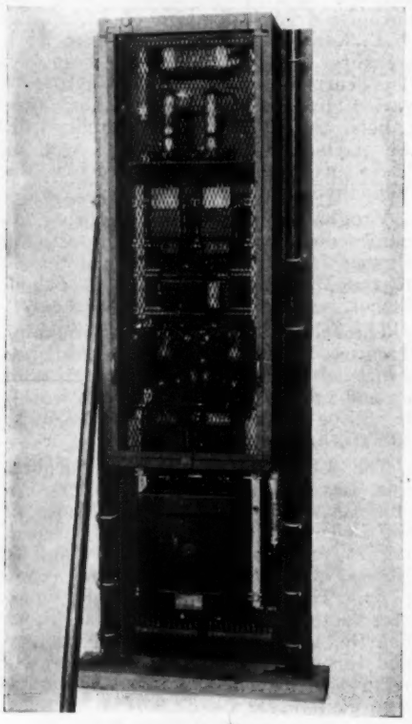
The Texas Creosoting Company, Orange, Tex., announces that in the future its "Black Beauty" poles can be more easily identified as the roof of each pole will be painted a brilliant red. This mark of identification will be in addition to the use of the usual dating nail.

The Railway & Industrial Engineering Company, Greensburg, Pa., announces that it is furnishing the entire outdoor 220-kv. equipment for the Conowingo plant of the Susquehanna Power Company.

New Equipment Available

Vacuum-Tube Synchroscope

A vacuum-tube synchroscope, which gives a direct indication of whether incoming machines are running too fast or too slow and shows the difference in speed without any time lag, has been developed by the General Electric Company. The vacuum tube synchronizing equipment provides the usual fast, slow and synchronism indications without the use of instrument potential transformers. Potential from the lines to be synchronized is obtained from a capacitance coupling and is then amplified by means of vacuum tubes until sufficient power is obtained to operate a synchroscope. Standard oil-filled bushings of transformers, oil circuit breakers or other apparatus can be replaced by a modified bushing with a capacitance coupling designed for furnishing potential to the vacuum-tube apparatus. Where such bushings are not in use, the capacitance coupling can be supplied in a separate tank which can be installed either outdoors or indoors. The voltage obtained in this way is in phase with the line-to-neutral voltage of the system. A capacitance coupling must be provided at each point where a potential transformer would be necessary if transformers were used for synchronizing.



REAR VIEW OF STANDARD STATION EQUIPMENT ON A THREE-SECTION PANEL. THE SYNCHROSCOPE IS MOUNTED ON A BRACKET

The potential obtained from the capacitance coupling is impressed on the grid filament circuit of a vacuum tube and amplified. This tube should not be more than 50 ft. from the coupling. The low-power amplifier is built into a weatherproof housing for outdoor mounting. One such amplifier is required for each bus and line to be synchronized. The low-power outdoor amplifier requires a five-wire multiconductor cable with 500-volt insulation between the amplifier and the substation, where high-power amplifiers are installed.

The station equipment consists of a tube and control unit, a motor-generator set and the synchroscope. The tube and control unit consists of two 50-watt amplifying tubes and their associated equipment. These tubes will amplify the energy received from the low-power amplifier sufficiently to operate the indicating synchroscope. The high-power amplifying equipment will take care of any number of synchronizing points at one substation.

Resistance-Type Furnace

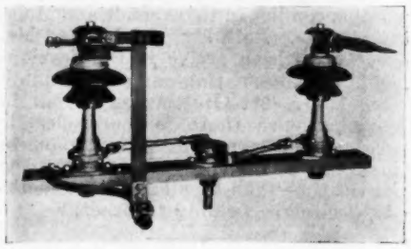
A resistance-type furnace for operating at temperatures from 1,800 deg. F. to 2,500 deg. F. continuously and up to 2,800 deg. F. for intermittent service has been developed by C. I. Hayes, 129 Baker Street, Providence, R. I. The furnace is offered in two standard sizes, but other special sizes can be furnished if desired. These furnaces use "globar" heating elements that may be operated on either alternating or direct current at the usual voltages up to 220, or alternating-current voltages as high as 550 may be used.

The inner lining, which forms the walls of the heating chamber, is a special molded " carbofax" form capable of withstanding temperatures of 3,000 deg. F. or over. This is backed up with several courses of heat insulation. Immediately back of the heating chamber is a layer of high temperature insulation, which is non-shrinking up to 2,500 deg. F. This is followed by layers of "sil-o-cel" and high-pressure block, all being inclosed in a furnace case of boiler-plate construction. The "globar" heating elements are in the form of rods, which may be mounted in the top of the heating chamber, under the hearth, or both, depending on the design of the furnace or the purpose for which it is to be used. They may also be mounted along the side walls from front to back when best suited to the working conditions. Furnace temperatures may be controlled either by hand or automatically, and when control of atmospheric conditions in the furnace chamber is necessary, as in the case of hardening high-speed steel, this can be easily and positively cared for. The complete equipment consists of furnace, transformer and automatic control apparatus.

Ohmmeter. — The type COM ohmmeter, developed to meet the demand for a small, compact, rugged and reliable resistance measuring instrument for measuring resistances from 0.5 ohm to 50,000 ohms, has been placed on the market by the Roller-Smith Company, 233 Broadway, New York. The instrument is direct-reading and has a self-contained dry cell which is easily replaceable.

Combination Disconnecting and Grounding Switch

A combination gang-operated disconnecting and grounding switch, one element of which is illustrated, three of these being interlocked for multipole operation, has been developed by the Delta-Star Electric Company, 2400 Block, Fulton Street, Chicago. In this type of switch both insulator units rotate and the grounding contacts are clamped to one of the switch blades so that the grounding blade can enter the grounding contact only when the main switch is in open position. The operating mechanisms are also interlocked to prevent operation of the grounding switch when the main switch is closed or vice versa. Both the main switch and grounding switch are provided with double self-aligning contacts.



SINGLE-POLE ELEMENT OF COMBINATION GANG-OPERATED DISCONNECTING AND GROUNDING SWITCH

Automatic Carbon Arc Welder for Range Boilers

An automatic high-speed carbon arc welder for range boilers, designed to meet the particular needs of the producers of range boilers, has been developed by the Lincoln Electric Company, Cleveland. On 14-gage steel the automatic carbon arc welder makes a speed of 150 ft. per hour at a cost of slightly over 1 cent a foot of longitudinal seam. The cost per foot on the head seams is somewhat less than on the side seams. The side seam is welded with a filler rod which is laid on the seam and fused into the joint by the carbon arc.

The range boiler is slipped on the mandrel of the machine and the top clamps lowered to hold the seam in position. Water-cooled copper guards confine the arc to the seam. The clamps also carry the upper rail on which is mounted the carriage for the automatic welding head. To operate the machine it is only necessary to start the arc. The motor-driven head is then carried along the seam, fusing the filler and the edges of the seam together. While the welder is built primarily for the completely welded range boiler, it is also adapted to the welding of the riveted and welded range type of boilers, in which the rivets are spaced rather widely and the weld is applied to the lap for pressure tightness.

New Trade Literature

AIR CIRCUIT BREAKERS.—The General Electric Company, Schenectady, N. Y., is distributing leaflet GEA-780, covering its solenoid-operated air circuit breakers, types CP-3, CK-3 and CP-7.

CONDUIT FITTINGS. — The Crouse-Hinds Company, Syracuse, N. Y., is distributing bulletins G-3 and G-5, covering its type GCE groundlet and groundlets and other safety circuit devices respectively. The company has also issued bulletin G-4, entitled "Grounding for Safety," in which it gives reasons and recommendations for grounding both high and low tension wires.

ELECTRIC MERCHANDISING DATA.—The Edison Electric Appliance Company, Inc., 5600 West Taylor Street, Chicago, is distributing a booklet entitled "Hotpoint Servants 1927 Merchandiser," containing an outline of Hotpoint sales and advertising plans for the last six months of 1927. Copies of newspaper advertisements and bulletins advertising various "Hotpoint" appliances are shown. Suggestions for window display and material for same are included.

TESTING LABORATORIES. — Vol. 4, No. 2, issue of "The Delta Star," published by the Delta-Star Electric Company, 2400 Fulton Street, Chicago, is a special message to executives calling attention to the importance of manufacturers having research facilities. It presents some excellent illustrations of the high-voltage laboratories of Stanford University, California Institute of Technology, Ohio Brass Company, General Electric Company, Westinghouse Electric & Manufacturing Company, Simplex Wire & Cable Company, Electrical Testing Laboratories and the Delta-Star Electric Company.

ELECTRIC EQUIPMENT FOR BAKERIES, HOTELS AND RESTAURANTS.—The Edison Electric Appliance Company, Inc., 5600 West Taylor Street, Chicago, has issued its dealers' catalog No. G5 for 1927-28, covering the "Hotpoint" electric servants, also ranges and water heaters, and the Edison bakery, hotel and restaurant equipment. In this catalog 45 new "Hotpoint" servants are shown. Several pages are devoted to the advantages of the company's heavy-duty equipment. The company has also issued catalog G-7, in which is described and illustrated the Edison electric cooking equipment for hotels, bakeries, hospitals, public institutions, marine galleys, etc.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in San Juan, Porto Rico (No. 26,567), for storage batteries and parts.

An agency is desired in Cairo, Egypt (No. 26,571), for electric elevators.

An agency is desired in Colombo, Ceylon (No. 26,561), for electric fans.

Purchase and agency are desired in Havre, France (No 26,536), for electrical household equipment.

An agency is desired in Hamburg, Germany (No. 26,564), for electrical household equipment and electric household refrigerators.

Purchase and agency are desired in San Juan, Porto Rico (No. 26,567), for automobile lamps.

An agency is desired in Vienna, Austria (No. 26,565), for electric household refrigerators.

An agency is desired in Prague, Czechoslovakia (No. 26,563), for electrical portable tools; also for stationary-type vacuum cleaners (No. 26,566).

Purchase and agency are desired in Oslo, Norway (No. 26,562), for X-ray screens.

Purchase and agency are desired in Oporto, Portgual (No. 26,667), for battery-charging sets. An agency is also desired for household electrical appliances and wiring supplies (No. 26,610).

An agency is desired in Prague, Czechoslovakia (No. 26,583), for electrical elevator-control apparatus.

An agency is desired in Lausanne, Switzerland (No. 26,670), for electric floor polishers.

An agency is desired in Hamburg, Germany (No. 26,592), for household electric appliances.

Sole agency is desired in Bradford, England (No. 26,669), for electric washing machines and vacuum cleaners.

An agency is desired in Lourenzo Marques, Portuguese East Africa (No. 26,668), for wiring supplies.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

GORHAM, N. H.—The Twin States Gas & Electric Company, Boston, is planning to increase the capacity of its local plant by 300 kw.

WEST STEWARTSTOWN, N. H.—Work has been started by the Southern New Hampshire Corporation, Colebrook, on expansion of the hydro-electric plant on the Connecticut River, between West Stewartstown, N. H. and Canaan, Vt. The work includes the construction of a wooden pipe line, 1,400 ft. long. A power house will be built at the end of this pipe line, equipped with an 1,100-kw. generator and waterwheel. A 33,000-volt transmission line will be erected between Canaan and Lancaster, N. H., to interconnect with the high-tension line of the Twin States Gas & Electric Company which extends from Gorham, N. H., to St. Johnsbury, Vt.

Middle Atlantic States

BROOKLYN, N. Y.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Aug. 16, for furnishing telephones, testing generators, vegetable peeling machines, wire, insulating fiber, electrical supplies, etc., to be delivered at the Naval Supply Depot, Brooklyn.

BUFFALO, N. Y.—Plans have been filed by the New York Central Railroad Company, New York for the construction of a steam-operated electric power plant at 301 Curtiss Street, to cost $140,000.

PLATTSBURG, N. Y.—The Plattsburg Gas & Electric Company has applied for permission to extend its transmission lines into Dannemora township to serve electricity there.

PRESTON, N. Y.—Permission has been granted the New York State Gas & Electric Corporation, Ithaca, to erect a 2,300-volt transmission line from Norwich into the town of Preston, a distance of about 6 miles, to furnish electric service in the township and the Chenango County Home.

RUSHVILLE, N. Y.—The Empire Gas & Electric Company, Geneva, plans to extend its high-tension line from Gorham to Rushville.

WALDEN, N. Y.—Authority has been granted the Wallkill Valley Electric Light & Power Company to extend its electric system in the towns of Crawford and Montgomery.

HARRISBURG, PA.—The City Council is considering the installation of a central fire-alarm system, to cost about $75,000.

PHILADELPHIA, PA.—Bids will be received by C. E. Walsh, purchasing agent, Pennsylvania Railroad Company, Room 415, 15 North Thirty-second Street, for conductor cable (Contract 101-1927).

WILMINGTON, DEL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until August 25 for furnishing material and installing conduit, wiring and lighting fixtures in the United States Custom House at Wilmington. For details see Searchlight section.

HAGARSTOWN, MD. — Permission has been granted to the Potomac Edison Company to extend its transmission lines from Buckeystown to various communities in Montgomery County.

MOUNDSVILLE, W. VA.—The installation of an ornamental lighting system in the downtown district is under consideration by the City Council.

RICHMOND, VA.—The Virginia Electric & Power Company contemplates extending its transmission line to the municipal airport for light and power service.

SOUTH CHARLESTON, W. VA.—The Westvaco Chlorine Products Company plans to build a power plant in connection with proposed extensions at its local works. The equipment will include one 2,500-kva., turbo-generator, four 3,000-kw. rotary converters, switchboard, etc. The cost of the entire project is estimated at $500,000.

North Central States

ALLEGAN, MICH.—Bonds to the amount of $185,000 have been voted to cover the initial cost of the construction of a hydro-electric plant on the Kalamazoo River and to acquire a lighting plant. The plant will be equipped with three generating units of 95 kw. each. The cost of the entire project is estimated at $440,000.

DETROIT, MICH.—Plans have been filed by the Ditzler Color Company, 40 West Baltimore Avenue, for a power plant, to cost about $40,000 on the West Chicago Boulevard, in connection with a proposed new factory.

FERNDALE, MICH.—The Detroit Edison Company, Detroit, plans to build a local substation, to cost about $300,000.

CINCINNATI, OHIO.—The Cincinnati & Suburban Power Company plans to rebuild its substation in the Indian Hill district, recently damaged by fire.

LOUISVILLE, KY.—Plans are under way by the Kentucky Utilities Company for the erection of a 33,000-volt single-circuit line from Bardstown to New Haven, a 6,600-volt line from Paducah to Lone Oak, and a 66,000-volt line from Pineville to Manchester, 20 miles long.

BRAZIL, IND.—Bids will be received by the Hospital Board of Clay County, Court House, until Sept. 12, for electrical work in the proposed county hospital, to cost about $140,000; also, for installation of complete refrigerating equipment. Rodney W. Leonard, Peoples Life Building, Frankfort, is architect.

PARK FALLS, WIS.—Bids will soon be asked by the City Council for the installation of an ornamental lighting system, covering eleven blocks.

ATWATER, MINN. — The Northern States Power Company, Minneapolis, which has acquired the local electric plant has started work on the erection of a high-tension line from Paynesville to Grove City and Atwater. A new street-lighting system will be installed at once.

REDWOOD FALLS, MINN.—F. H. Shoemaker, Green Bay, Wis., is at the head of a project to build a hydro-electric plant on the Minnesota River, about 5 miles north of here.

ST. PAUL, MINN.—The City Council has authorized the installation of an ornamental lighting system on Aldine Street. The installation of ornamental lamps on portions of Sixth and Searle Streets is under consideration by the Council.

CANTON, IOWA — The Eastern Iowa Power Company, Maquoketa, has applied for permission to build a power dam at Canton. The new dam will be built on the old dam site.

MEXICO, MO.—The erection of a high-tension transmission line along the Missouri Highway No. 6 from Phillipsburg to Waynesville is under consideration by the Missouri Power & Light Company.

DEVILS LAKE, N. D.—Authority has been granted the Otter Tail Power Company, Fergus Falls, Minn., to change the electric system at Lankin, Adams, Edinburg and Milton from direct to alternating current. The company was also granted permission to erect transmission lines from Fordville to Milton, and from Fairdale to Edinburg.

DRISCOLL, N. D.—Permission has been granted the Northern Power & Light Company, Mobridge, S. D., from Driscoll to Tappen; also to erect lines from Wiskeh to Dawson, and from Driscoll to Temvik.

EDINBURG, N. D.—The Otter Tail Power Company, Fergus Falls, Minn., which has acquired the local electric system, plans extensions and improvements to the system, including transmission line construction.

LEHIGH, N. D.—Plans for the proposed local fuel briquette plant to be built by the Lehigh Briquetting Company, to cost about $300,000, include a power plant. R. W. Richardson, 116 East Fourth Street, St. Paul, Minn., is engineer.

McGREGOR, N. D.—The State Railroad Board has approved the erection of a transmission line to be built by the Montana-Dakota Power Company, Minneapolis, from McGregor to Grenora, and from Grenora to Powers Lake.

Southern States

JEFFERSON, N. C.—Preliminary work has been started by the Jefferson Power & Light Company on the construction of a dam and power station on the north fork of the New River. The company plans to supply electricity in Jefferson and West Jefferson and surrounding towns.

SUMTER, S. C.—Plans for the proposed local stave mills to be erected by the Brooklyn Cooperage Company, 142 Kent Avenue, Brooklyn, N. Y., to cost about $500,000, include a power house.

GRIFFIN, GA.—The Georgia Power Company, Atlanta, plans extensions to its local substation including the installation of additional equipment. A transmission line is contemplated to Woodbury, Molena, and vicinity.

OCALA, FLA.—At special election to be held Sept. 6, the proposal to issue $150,000 in bonds for extensions and improvements in the municipal electric plant will be submitted to the voters.

DAYTONA BEACH, FLA.—The city officials are considering the installation of a new uniform street lighting system throughout the city, with a view of entering into a new contract with the Florida Power & Light Company for street lighting.

ERIN, TENN.—The Tennessee Electric Power Company, Chattanooga, plans to install an additional 300-hp. generating unit at its local electric plant, with auxiliary equipment.

MORRISTOWN, TENN.—The Grainger County Electric Company, recently organized with a capital stock of $15,000, proposes to furnish electricity from the local municipal electric plant to Tate Springs. E. T. Bettis and John R. King are among the incorporators.

BLUE MOUNTAIN, MISS.—Negotiations are under way between the city officials of Blue Mountain and New Albany with a view of securing electricity from the municipal electric plant at Albany for service in Blue Mountain. Under the present plans the town of Blue Mountain is to erect a high-tension from the city limits of New Albany here and to install a local distributing system.

HANCEVILLE, ALA.—Plans are under way by the Municipal Water & Light Company, for the construction of a steam-operated electric plant, to cost about $75,000.

MONROEVILLE, ALA.—The Gulf Utilities Company, New Port Richey, Fla., has purchased the plant of the Monroeville Ice & Power Company and plans extensions and improvements in this section, including transmission line construction.

LAUREL, MISS.—Bids will be received by the Board of Street Commissioners until Aug. 29, for the installation of an ornamental lighting system on Sixth Avenue, Thirteenth Street, and other thoroughfares.

COLUMBIA, LA.—The Louisiana Power & Light Company, Pine Bluff, Ark., which has acquired the municipal electric plant, plans extensions in its transmission lines for local service.

NEW ORLEANS, LA.—Bids will be received by the Sewerage and Water Board of New Orleans, at the office of A. G. Moffat, secretary, 526 Carondelet Street, until Sept. 29 for furnishing electric machinery.

BROMIDE, OKLA.—Plans are under way by the Public Service Company of Oklahoma, Tulsa, to erect a transmission line to Bromide, 5 miles long, to furnish electric service here.

HOMINY, OKLA.—The Oklahoma Utilities Company is planning to erect a transmission line from Cleveland, via Skedes and Blackburn to Ralston, and to connect with the line extending north to Fairfax and Burbank.

DUMAS, TEX.—Plans are under way by the Dumas Utilities Company for the construction of a steam-operated electric power plant for local service.

FALFURRIAS, TEX.—Work will soon be started by the Central Power & Light Company, San Antonio, on the erection of a high-tension (wooden pole) line from Kingsville to Falfurrias. The company has purchased the local electric light and waterworks systems.

NAVARRO, TEX.—The Texas Power & Light Company, Dallas, is extending its transmission line to Navarro, Angus, Pickett, Corbet and Puroon. A branch line is to be erected from Pickett to the Pisgah Ridge rock quarry.

NAVASOTA, TEX.—The Western Public Service Company, Beaumont, plans to erect 66,000 and 33,000-volt transmission lines through Liberty, Montgomery, Trinity, Madison and Grimes Counties, the lines to be connected with the Neches power plant of the Gulf States Utilities Company at Beaumont. The cost of the project is estimated at $800,000.

Pacific and Mountain States

AZUSA, CAL.—The City Council has authorized the installation of an ornamental lighting system on portions of Orange, Sunset, and Angeleno Avenues, using concrete standards.

BRAWLEY, CAL.—Bids will be received by the City Council until Sept. 6 for the installation of an ornamental lighting system on Main Street, from Tenth Street to the western city limits.

CULVER CITY, CAL.—The City Council has authorized the installation of an ornamental lighting system on portions of Coolidge, Minerva, Berryman, and Butler Avenues from Washington Boulevard to the northwestern city limits.

SAN FRANCISCO, CAL.—The Down Town Association has petitioned the Board of Supervisors to install modern lamp standards in all downtown districts where gas lamps are still in use.

MULLAN, IDAHO.—The Public Utilities Consolidated Corporation, St. Paul, Minn., operated by W. B. Foshay Company, plans to erect transmission lines to connect the systems of the Mullan Light Company, and the Canyon Light & Water Company, Burke.

BUTTE, MONT.—The City Council has authorized the establishment of a new ornamental lighting district, known as Improvement District No. 342. H. J. Wiegenstein is engineer.

CANON CITY, COLO.—Surveys will soon begin by the Southern Colorado Power Company, Pueblo, for a proposed hydro-electric plant on the Arkansas River, near Canon City. A transmission line will be built. The cost of the project is estimated at $500,000.

DENVER, COLO.—The Gates Rubber Company, 999 South Broadway, plans to build a steam-operated electric power plant at its factory, to cost about $200,000. Wood & Weber, Midland Savings Building, are consulting engineers.

Canada

AMHERSTBURG, ONT.—New estimates are being asked by the City Council for the installation of an ornamental lighting system, to cost about $24,000.

WHITBY, ONT.—Plans are under way by the Hydro-Electric Power Commission of Ontario to extend its 44,000-volt transmission line from Oshawa to Whitby. A substation will be built in Whitby.

Electrical Patents

Announced by U. S. Patent Office

(Issued July 26, 1927)

1,636,678. PUSH-AND-PULL SWITCH; B. A. Benson, Chicago, Ill. App. filed March 18, 1925.

1,636,698. THERMALLY CONTROLLED SIGNALING DEVICE: F. C. Leonard and C. W. Rietzel, Providence, R. I. App. filed July 20, 1925.

1,636,707. ELECTRIC CIRCUIT TESTER: W. F. Robinson and F. P. Robinson, Kansas City, Mo. App. filed March 3, 1924.

1,636,748. PAPER-INSULATED ELECTRIC CONDUCTOR; J. R. Long, Tarentum, Pa. App. filed Jan. 12, 1926. Having a paper insulating envelope formed of one or more spirally wound layers of paper of composite character having opposite surfaces formed of different materials.

1,636,788. ELECTRIC STEAM BOILER: E. Schleck, Berlin, Germany. App. filed Jan. 16, 1926.

1,636,798. ATTACHMENT PLUG; E. C. Ballman, St. Louis, Mo. App. filed Nov. 9, 1923.

1,636,882. ELECTRICAL SWITCH; G. B. Wadsworth, Covington, Ky. App. filed Jan. 5, 1920. For motor starting. Used to throw in progressively different windings or resistances.

1,636,895. ELECTRIC SWITCH; F. A. Boedtcher, Bergenfield, N. J. App. filed May 19, 1923. Intended for employment in conjunction with the resetting circuits of elevator signaling systems.

1,636,900. ELECTROMAGNETIC SWITCH FOR CONTROLLING THE CIRCUITS OF TRAIN LIGHTING AND SIMILAR INSTALLATIONS; A. H. Darker, Upper Norwood, London, England. App. filed Feb. 4, 1922.

1,636,923. ELECTRIC HAMMER AND DRILL; N. Piscionere, South Weymouth, Mass. App. filed March 12, 1925.

1,636,932. INTERLOCKING ELECTRIC SWITCH; W. B. Burke and E. G. Weiler, East Cleveland, Ohio. App. filed July 5, 1923. For cell doors of inclosed high-voltage apparatus.

1,636,933. RELAY; L. J. Girard, Thionville at Suresnes, France. App. filed Nov. 6, 1925. Which utilizes the variation of the intensity of the current traversing the conductor wherein the relay is inserted.

1,636,939. ANGLE PLUG; T. J. Kerwin, Chicago, Ill. App. filed Jan. 3, 1921.

1,636,941. PROCESS AND APPARATUS FOR RECHARGING MAGNETS; S. V. Losey, Detroit, Mich. App. filed May 24, 1926.

1,636,953. THERMAL PROTECTIVE DEVICE FOR ELECTRIC CIRCUITS; O. Dreyer, Essen-on-the-Ruhr, Germany. App. filed Oct. 17, 1925.

1,636,970. PROCESS AND APPARATUS FOR LIGHTING; N. Sulzberger, New York, N. Y. App. filed May 12, 1922. Luminous material (chemicals, colors, alone or in mixture) used in connection with surfaces which are for longer or shorter periods exposed to light (daylight and artificial).

1,636,973. EXTENSION CORD FOR ELECTRICAL APPLIANCES; J. M. White, Philadelphia, Pa. App. filed Feb. 10, 1925.

1,638,984. MULTIPLE-BREAK ELECTRIC SWITCH; L. A. Brown, Uniontown, Pa. App. filed July 3, 1926. For making and breaking electric circuits under heavy load and which will operate without producing a flame or flash.

1,637,015. CURRENT RECTIFYING AND CONTROLLING SYSTEM; B. T. Umsted and N. Harris, Jackson, Tenn. App. filed April 27, 1923. In which the resistance coils shall be so arranged that the greatest possible number of batteries can be recharged by a 110-volt current at the same time.

1,637,016. PROCESS OF REPLACING BROKEN OR MOLTEN HOLDING WIRES INSIDE OF INCANDESCENT ELECTRIC LAMPS; F. Voglhut, Augsburg, Germany. App. filed Sept. 17, 1925.

1,637,031. ELECTRIC WELDING; H. W. Tobey, Pittsfield, Mass. App. filed Aug. 10, 1923. Of circumferential seams such as are encountered in the manufacture of metal barrels.

1,637,032. PROTECTIVE DEVICE; O. C. Traver, Schenectady, N. Y. App. filed May 13, 1922. For alternating-current electric systems wherein an electric quantity at one point of a system is balanced against a similar electric quantity at another point of the system for protective purposes.

1,637,033. COMPOSITE ELECTRIC CONDUCTOR; D. Basch, Schenectady, N. Y. App. filed June 5, 1925. Aluminum-coated copper conductor.

1,637,034. COILED-FILAMENT INCANDESCENT LAMP; J. Bergmans, Eindhoven, Netherlands. App. filed Dec. 4, 1923.

1,637,038. ROTARY SWITCH; F. C. De Reamer, Bridgeport, Conn. App. filed Nov. 30, 1925.

1,637,039. SYSTEM FOR THE TRANSMISSION OF ANGULAR MOTION; E. M. Hewlett and W. W. Willard, Schenectady, N. Y. App. filed Dec. 5, 1924. Having means whereby when the transmitting device is inoperative other devices in the system may be used as a transmitting device.

1,637,040, 1,637,041. SELF-EXCITED INDUCTION MOTOR; J. I. Hull, Schenectady, N. Y. App. filed Feb. 9, 1924. Means for controlling the power factor of an induction motor.

1,637,042. COMBINED AUTOMATIC AND MANUAL CIRCUIT CONTROLLER; L. P. Hutt, Schenectady, N. Y. App. filed Dec. 13, 1926.

1,637,043. PHASE-FAILURE PROTECTION B. W. Jones, Schenectady, N. Y. App. filed Aug. 28, 1925. Will automatically open the circuit upon a reversal of the phases or failure of a portion of the phases and keep the circuit open until polyphase energization is restored.

1,637,046. DECORATIVE LIGHTING OUTFIT; V. M. Montsinger, Pittsfield, Mass. App. filed April 22, 1922. For Christmas trees and the like.

1,637,049. ELECTRIC METER; W. H. Pratt, Lynn, Mass. App. filed Dec. 17, 1926. Of the integrating type; means for compensating such meters for changes in frequency.